THE ONTARIO WATER RESOURCES COMMISSION

REPORT ON

WATER RESOURCES SURVEY

COUNTY OF NORFOLK

1963

A

WATER RESOURCES SURVEY

of the

COUNTY OF NORFOLK

1963

INTRODUCTION

PURPOSE

The Ontario Water Resources Commission is endeavouring to assist municipalities and industry in making the best use of the province's water resources and to point out the continued need for the responsible development and management of these resources. In accordance with these objectives, the Commission employs the water resources survey to study the needs of municipalities within the county unit.

A survey of the County of Norfolk was undertaken in 1963 and included a review of the water supply and water pollution control facilities wherever they existed. The operation of these works and the required improvements where necessary are outlined in this report. The requirements of areas not yet serviced with communal water and sewerage systems are a further consideration. The quality of surface waters and, to a certain extent, ground water is also reviewed to determine measures necessary to protect water quality.

The ultimate objective of the survey is to make recommendations concerning both general policies to be followed in the field of water supply and water pollution control, and problems where these may exist.

SCOPE

The general background of the county is outlined in the second and third chapters, and therein, the availability and quality of the water resources in the county are generally assessed. The problem of irrigation requirements is discussed.

More specifically, in the municipal chapters, brief descriptions of the water supply systems and water pollution control projects, whether municipal, private or industrial are provided for each municipality. The operation and capacity of these works has been investigated, and the adequacy of the facilities is outlined. Population projections are studied to determine the future requirements of the individual municipalities. These projections are based on the growth rates experienced during the past decade and the expected development of the specific area. An attempt is also made to relate the quality of the surface waters in each municipality to the major sources of pollution therein.

It should be noted that the Commission continues to maintain a general surveillance over the many areas. Inspections of the water works and water pollution control plants in each municipality are performed. Detailed pollution surveys will be made in the individual municipalities as required. In these various investigations the assistance of the health authorities is considered to be invaluable. This work permits a continuing evaluation of the adequacy of treatment and operation provided at each water works and water pollution control plant, and the quality of the ground and surface waters.

The maps and figures outline the areas of ground-water availability; the locations of water works, water pollution control plants; the stream gauging stations and sampling points on the main watercourses; and the major sources of pollution.

The conclusions for each municipality are based on the findings of the survey. The recommendations result from these conclusions.

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SUMMARY AND RECOMMENDATIONS

CHAPTER 1

SUMMARY AND RECOMMENDATIONS

1.1 SUMMARY

The County of Norfolk contains 13 administrative areas consisting of four towns, one village and eight townships. The development of the county is oriented toward agriculture, particularly the cultivation of tobacco. Sufficient water resources are available to support its continued development provided that sound policies of water conservation including effective pollution control are pursued.

Surface water plays an important role in the county's economy. Domestic, industrial and, particularly, irrigation requirements make extensive demands on the surface water-courses. The withdrawal of water from natural sources is regulated by the OWRC permit system to ensure the equitable allocation of the available resources. However, more efficient use of available resources could be made by the effective conservation storage of water.

Ground water is generally available for domestic use throughout the county with the exception of certain areas in the townships of Walsingham South, Woodhouse and Townsend where the overburden does not yield adequate quantities of water and the bedrock yields water that is usually high in mineral content. Where shallow dug wells are depleted due to shortages of rain, it is often advisable to obtain water from greater depths. Some of the wells in Walsingham South could be improved in this manner, whereas in certain areas of the townships of Townsend and Woodhouse the proximity of rock to the ground surface limits the practicability of this method. The OWRC is prepared to assist municipalities to locate and develop potential sources.

The major urban centres, the towns of Simcoe, Delhi, Port Dover, Waterford, and the Village of Port Rowan are served by municipal water systems. Delhi and Simcoe have provided systems for sewage collection and treatment. Pollution control facilities at Simcoe have been expanded to meet the existing and anticipated treatment requirements. Waterford also has installed sewage works which are serving the major built-up area of the town. At the moment, Port Dover and Port Rowan do not provide municipal sewage treatment facilities. However, the former is proceeding

with the construction of a municipal sewerage system. In Simcoe, Port Dover and Waterford, the Commission has co-operated with these municipalities in projects designed to control pollution.

The county is situated within the Lake Erie drainage basin. The largest streams are the Lynn River, Big Creek and Nanticoke Creek.

The water quality of the streams is generally satisfactory in the rural areas. However, major sources of pollution have been located in the towns of Simcoe, Delhi, Port Dover and the Village of Port Rowan. As well, significant pollution has been demonstrated at Courtland in the Township of Middleton. The pollution abatement programmes already begun by municipalities and industries should be extended to include any remaining sources of pollution.

The location and operation of the Waterford-Townsend Township refuse disposal area has resulted in serious pollution of Nanticoke Creek. The site employed by Simcoe presents a potential source of pollution, although elsewhere refuse disposal does not pose a problem at the moment. Careful supervision of the established sites should be maintained.

On occasion fish kills have been reported to the Commission. These have been considered to be variously associated with the disposal of contaminated drainage wastes and misuse of agricultural pesticides. Particular care is required in the handling and application of these chemicals to ensure protection of surface drainage systems and watercourses.

1.2 RECOMMENDATIONS

County of Norfolk

The county should encourage:

1. Water conservation programmes by municipalities and individuals to alleviate supply problems.

2. The continued development of municipal pollution abatement programmes related to the disposal of domestic sewage, trade wastes and solid refuse.

Town of Simcoe

Water Supply

1. As required, disinfection by chlorination should be undertaken if continued evidence is found of contamination of the municipal water supply.

2. If the current test drilling programme proves successful, consideration should be given to using the new source(s) for regular requirements and maintaining the Cedar St. works for reserve.

Water Pollution

1. The sources of pollution in the storm drainage systems should be located and eliminated.

2. Uncontaminated industrial cooling waters should be redirected from sanitary sewers to storm or surface-water drains where possible.

Town of Delhi

Water Supply

1. The construction of the water conservation dam and reservoir on North Creek should be completed as soon as possible.

2. Effective planning for improvements in water supply facilities to meet emergency and peak water demands should be undertaken.

Water Pollution

1. Steps should be taken to ensure the protection of the water quality associated with the new conservation reservoir as it may be affected by private sewage disposal practices in the Township of Middleton.

2. The sources of pollution of the storm drains on Eagle and Imperial Streets should be located and discontinued.

Town of Port Dover

Water Supply

1. As required, the filtration plant should be extended

to meet future water demands.

Water Pollution

1. With the completion of the immediate sewage treatment programme, efforts should be continued toward the elimination of any additional sources of pollution which may not be included in the current project.

Town of Waterford

Water Supply

1. The recently proven new sources of ground water should be developed to meet the town's needs for additional supply and improved quality water.

Water Pollution

1. The established pollution abatement programme should be extended to eliminate all untreated waste discharges to Nanticoke Creek.

2. The new site for refuse disposal should be located such that ground and surface waters are protected from pollution caused by refuse leachate. Additionally, effective measures are required to control the pollution which will continue to be a problem at the present site.

Village of Port Rowan

Water Supply

There are no recommendations.

Water Pollution

1. The Innes Foods Limited should exercise extreme care in operating the waste retention pond to ensure that adequately treated effluent is discharged only during periods of heavy runoff.

2. The village should institute planning for municipal sewage treatment facilities.

Township of Charlotteville

Water Supply

1. An integrated water supply and distribution system should be considered for the Turkey Point cottage area.

Water Pollution

The sources of pollution of the drainage systems in the police villages of St. Williams and Vittoria should be investigated and eliminated.

Township of Houghton

There are no recommendations regarding water supply or water pollution.

Township of Middleton

Water Supply

There are no recommendations.

Water Pollution

1. The sources of pollution of drains in Courtland should be located and eliminated.

2. Consideration should be given ultimately to the provision of municipal facilities in the residential development area adjacent to Delhi.

Township of Townsend

Water Supply

There are no recommendations.

Water Pollution

1. Refuse disposal operations at the existing site should be stopped and a suitable location selected for future operations. Effective measures are required to control the pollution which will continue to be a problem at the present site.

2. The Villa Nova Milk Products Co-operative should exercise close control over the operation of the spray irrigation system to protect Nanticoke Creek.

Township of Walsingham North

There are no recommendations regarding water supply or water pollution.

Township of Walsingham South

There are no recommendations regarding water supply or water pollution.

Township of Windham

There are no recommendations regarding water supply or water pollution.

Township of Woodhouse

Water Supply

Surface-water supplies should not be used without disinfection by chlorination or boiling.

Water Pollution

There are no recommendations.

CHAPTER 2

GEOGRAPHY AND GEOLOGY

CHAPTER 2

GEOGRAPHY AND GEOLOGY

2.1 GEOGRAPHY

2.1.1 Topography

The topography of the County of Norfolk consists mainly of a broad plain which slopes gently southward from an elevation of 800 feet in the north to 600-650 feet along the top of steep shorecliffs which rise up to heights of 100 feet or more above Lake Erie. In the northern sections, the plain is broken by three long north and north-east trending ridges which rise up to 75 feet above the surrounding countryside. Further relief is added to the plain by the deeply incised valleys of the numerous large creeks. Constant erosion of the shorecliffs has resulted in the availability of large quantities of material which have been deposited by lake currents in the form of sand spits, such as Long Point and Turkey Point.

2.1.2 Drainage

Drainage of the region is provided by large watercourses which flow southward into Lake Erie. The largest of these are the Lynn River and the Big, Nanticoke, and Otter creeks all of which have cut deep valleys across the sand plain, sometimes to a depth of 75 feet. Although generally good drainage exists along the creeks, drainage of some sections of the plain between the creeks is poor and large tracts of bog or wet sand exist. As a result in certain areas drainage tiles and ditches are used extensively to increase the runoff and land productivity. Drainage is discussed further in Section 3.2.

2.1.3 Climate

The climate is moderate with an annual average daily maximum temperature of 56^{o}F. and an annual average daily minimum of 36^{o}F. The annual average daily mean temperature at Simcoe over a 21-year period is 46^{o}F.

The annual precipitation averages 35 inches and is distributed fairly evenly over the 12 months of the year. Summer rainfall is greater in this area than in most of Southern Ontario and together with the moderate temperature contributes to a successful agricultural area.

2.1.4 Land Use

The county is highly developed for agricultural purposes with about 261,000 acres of arable land under cultivation.

Crops vary according to soil conditions. As sand covers most of the land surface, very suitable conditions exist for the growing of tobacco. About 60 per cent of the farm land is devoted to this crop, making Norfolk the leading tobacco producing county in Ontario. About 50 per cent of Southern Ontario's entire crop is grown here. Corn and wheat comprise other main crops, and are grown on the more clayey soils. Fruit and vegetable crops are common in the area south of Simcoe. Dairy farming is important, particularly in the clayey eastern regions of the county.

About 70 per cent of all tobacco farms use irrigation systems. Strawberry and tomato crops are also irrigated. Water for irrigation is obtained mainly from dug ponds and streams. Some is obtained from wells.

2.1.5 Population

The population of Norfolk County was 50,220 in 1962. This represents an increase of about 15,000 over 22 years. This sizeable increase in population is typical of the growth since the growing of tobacco was started in 1928. Prior to 1928 the population had been declining rapidly. The growing of other specialized crops and the establishment of industry followed.

Since 1948 the average annual rate of increase for the county has approached the provincial average of 2 per cent per year. For the purpose of this report, this rate of increase is used (Fig. 2-1) to estimate the future populations of the municipalities in the county.

2.2 GEOLOGY

The geological formations in the county consist of the consolidated bedrock formations of Devonian and Silurian age and the unconsolidated overburden materials that are mainly of Pleistocene age.

2.2.1 Bedrock

Brown to buff limestones of the Delaware formation and chert-bearing limestones and dolomites of the Bois Blanc formation are of Devonian age, and underlie the overburden

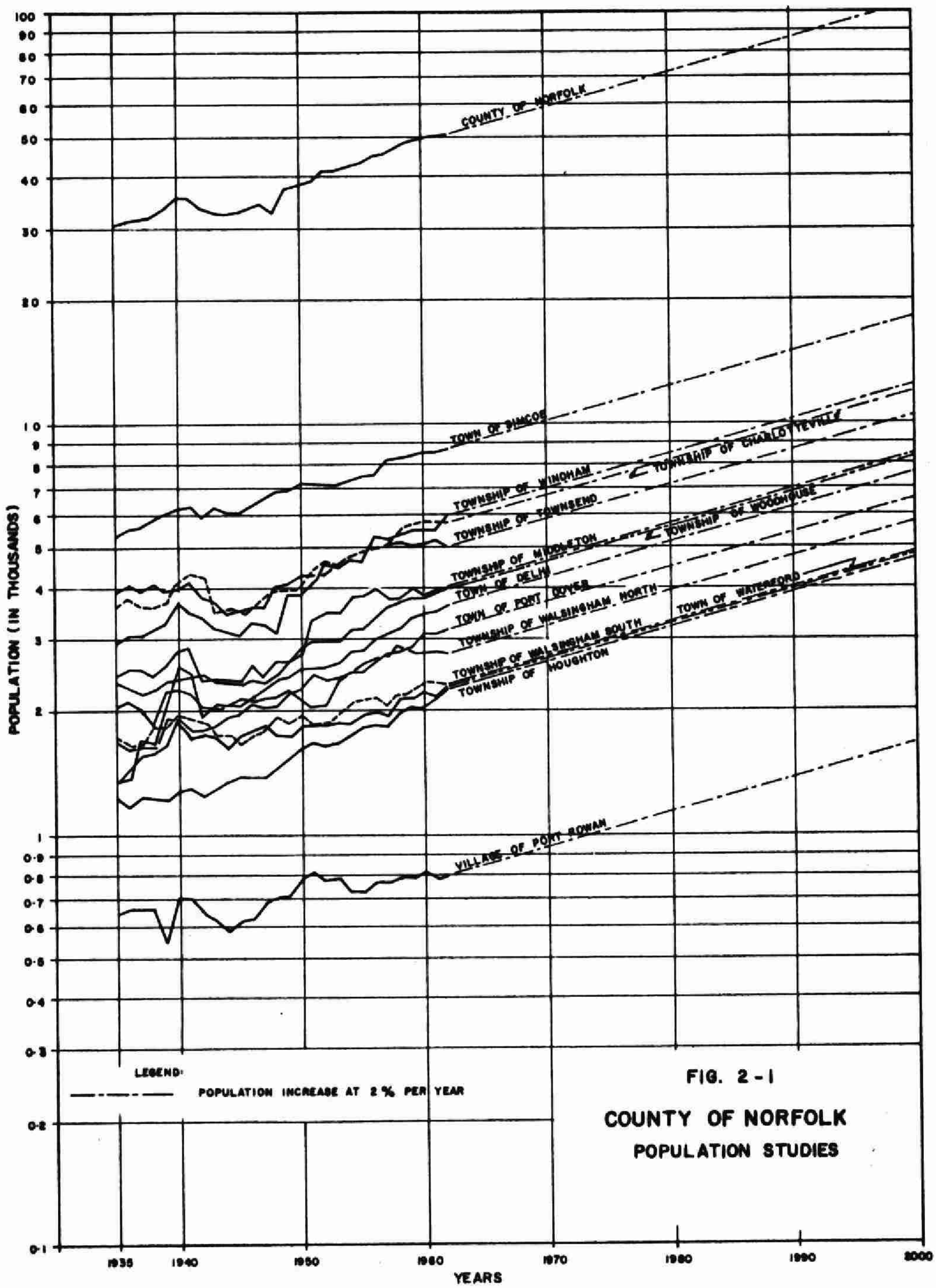

FIG. 2 - I

COUNTY OF NORFOLK

POPULATION STUDIES

in most parts of the county. Silurian age cream and buff dolomites of the Bass Island formation and buff to brown dolomites and limestones of the Salina formation underlie the overburden in a small north-east portion of the county and the Devonian rocks throughout the rest of the county. The rock formations dip gently to the south.

The bedrock formations are overlain by a mantle of unconsolidated overburden which varies in thickness from a few feet in eastern sections of the county to over 300 feet in the southern sections of the townships of Houghton and Walsingham South. The bedrock surface is for the most part low in relief and has a regional slope toward Lake Erie of 15 to 20 feet per mile. Highs in the bedrock surface appear to occur under the ridges in the northern regions. There are indications that depressions occur in the bedrock surface along some of the larger streams.

2.2.2 Overburden

The overburden was deposited mainly during the glaciation and deglaciation of the area during Pleistocene times. The principal types of deposits are ground and recessional moraines laid down by ice, a deltaic plain formed by meltwater discharging into glacial lakes, clay plains which were formed in the ancient glacial lakes, and beaches formed around their shores. More recent deposits are the sand spits which extend out into Lake Erie.

The materials deposited by ice are called till and consist of poorly-sorted mixtures of clay, silt, sand, gravel, and sometimes boulders. This material is believed to underlie most of the county and to comprise a large portion of the overburden. It is exposed mainly in the long morainic ridges in the northern sections. Till is exposed also as ground moraine in some places in the eastern sections of the townships of Townsend and Woodhouse.

The materials deposited in the delta consist of well-sorted sand and silt, and occasionally coarse sand or gravel. This material covers most of the county and is absent only on the morainic ridges and the clay or till plains. The deposit is believed to extend to depths up to 75 feet, but the thickness varies locally depending on the elevations of the underlying till.

The other materials deposited in the glacial lakes consist largely of clay. This material covers much of the eastern sections of the townships of Townsend and Woodhouse. Several

prominent sand and gravel beaches were developed during various phases of the glacial lakes.

As the last ice sheet advanced westward from the Lake Erie basin, it deposited a sheet of ground moraine which was derived from the bedrock and previous overburden deposits in the areas over which the ice had advanced. During deglaciation, the ice front retreated gradually to the east, but made several halts or short readvances. During these halts or readvances, till was built up in front of the ice in the form of moraines. Meltwater formed lakes in front of the ice. Great discharges of meltwater from the Grand River area also entered the lakes between the ice-front and the moraines and built a delta as the glacier withdrew to the east. The sands and silts of the region were thus deposited over the tills. Inundation by the glacial lakes resulted in the deposition of lacustrine clays along the southern and eastern edges of the delta and in the formation of beaches during various phases of the lakes. More recent erosion and deposition along the Lake Erie shore resulted in the formation of high shorecliffs and long sand spits in the present lake. Figure 2-2 shows the main overburden materials.

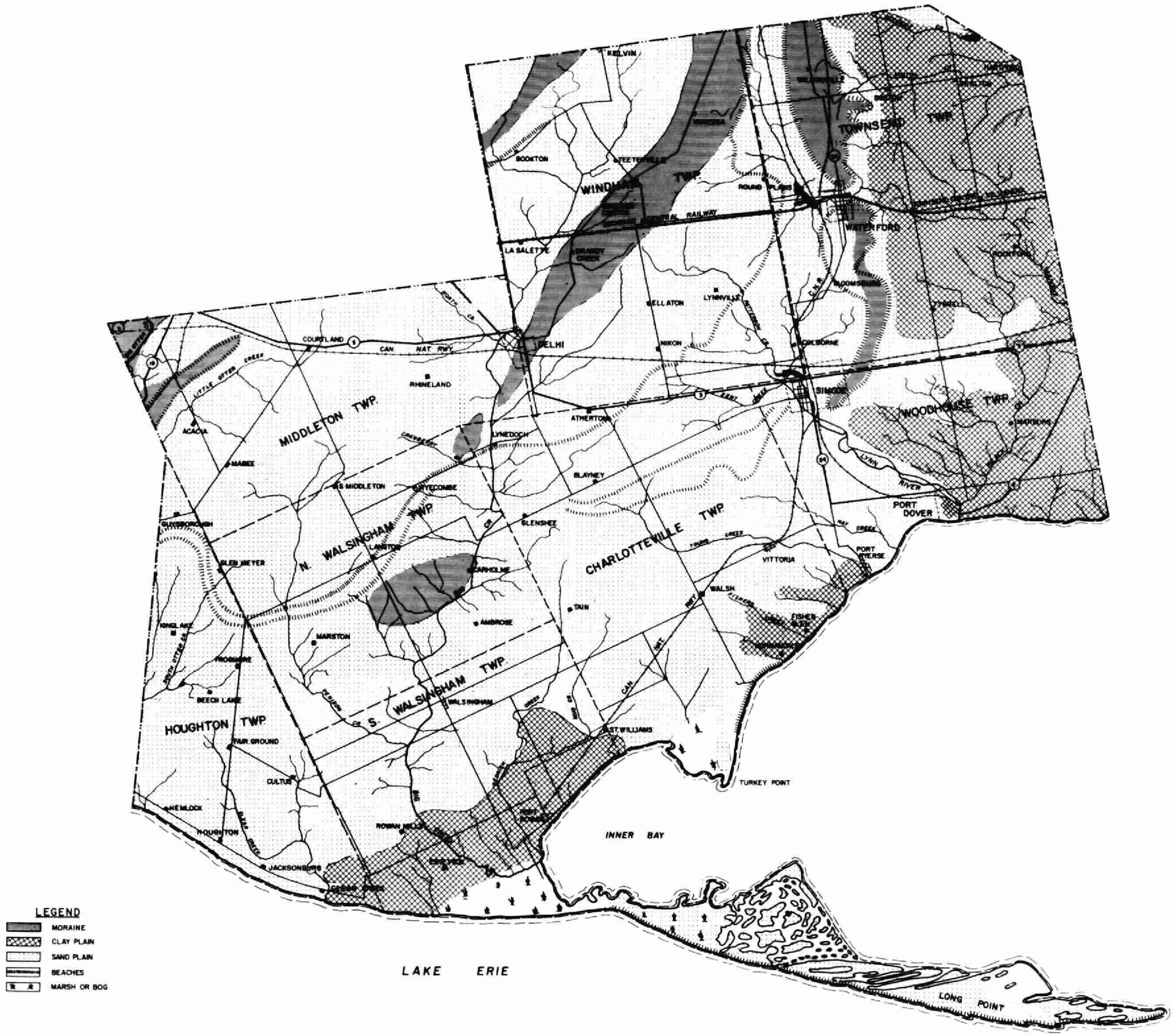

FIGURE 2-2

ONTARIO WATER RESOURCES COMMISSION

COUNTY OF NORFOLK

SHOWING

OVERBURDEN GEOLOGY

SCALE: MILES

DRAWN BY: S.H. DATE: NOV. 1963

CHECKED BY: R.W. DRAWING No.

CHAPTER 3

WATER RESOURCES

CHAPTER 3

WATER RESOURCES

3.1 GROUND WATER

3.1.1 Occurrence

Ground water is distinct from other waters occurring below the surface of the ground in that it is the water that occurs in the saturated zone. The water in this zone is part of the hydrologic cycle and is replenished by infiltrating precipitation from the land surface. As water infiltrates into the ground it passes through the unsaturated zone of aeration into the zone of saturation below. In the zone of saturation, water fills all openings in the earth's formations. The upper surface of this zone is called the water table. The depth to the water table varies from area to area according to the elevation of the land surface and the amount of precipitation. The water table fluctuates annually and is generally highest in the spring and lowest in the fall. Very little precipitation infiltrates past the zone of aeration during the summer.

Under the influence of gravity, ground water in the zone of saturation moves constantly. The rate of movement is controlled largely by the geology of the formations through which the water is passing. Formations consisting of materials such as clay, silt, and fine sand generally contain more pore spaces per unit volume and thus more water than formations of coarse sand or gravel. However, because of fine grain size, water will not move through the finer materials as readily as it will through the coarser. Because limestone and dolomite formations generally contain more fractures and joint planes, water can move more readily through them than shale formations. Formations that permit appreciable quantities of water to move through them are called aquifers.

In the county, ground water occurs in aquifers in three general types of formations; the surface sand, sand and gravel deeper in the overburden, and the limestone and dolomite bedrock. The surface sand covers most of the land surface and is therefore the most important aquifer. The water table is generally high in this material thus making the water readily available to shallow wells. The deeper sand and gravel deposits in the overburden appear to be patchy in distribution but are the best aquifers for high capacity wells. Aquifers in the bedrock are the main source of water for drilled wells in the eastern parts of the townships of Townsend and Woodhouse.

Bedrock aquifers are relied upon for water in areas in the county where overburden aquifers are lacking.

3.1.2 Water Quality

The following table shows chemical analyses of random water samples from the various aquifers in the county. All the analyses are in ppm except pH. Water samples from overburden aquifers were from wells in the Township of Middleton and the municipal spring supply at Delhi. Water samples from bedrock aquifers were from wells at Waterford.

TABLE 3-1

GROUND-WATER QUALITY-COUNTY OF NORFOLK

Aquifer	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chlorides as Cl	pH at Lab.	Sulfides as H_2S
Surface Sand	192 to 270	144 to 185	.09 to .70	11 to 49	7.8 to 8.0	0
Sand & Gravel in Overburden	194 to 256	200 to 222	.20 to 1.40	Trace to 15	7.7 to 7.9	0
Bedrock	300 to 500	172 to 216	.08 to .27	16 to 34	7.6 to 7.9	Present

The analyses show that ground water from overburden sources is generally hard but suitable for most purposes. The iron content varies widely in overburden aquifers and may be in excess of the 0.3 ppm maximum recommended for municipal supplies. Water from rock wells commonly contains hydrogen sulphide or other sulphur compounds which are present in such quantities in some parts of the county that the water is not potable. The mineral content may be due to the generally low regional permeability in the formations. Because of low permeability of the rock formations water moves very slowly and during its movement is able to dissolve large quantities of mineral out of the rock.

3.1.3 Availability

The availability of ground water in the county varies from good to excellent in some sections and poor to fair in

others. In each instance the main controlling factor is the geology.

Ground water is present in pore spaces in the overburden and in openings in the bedrock formations. Its availability to wells depends on the permeability of the formations, that is, the ability of the formations to transmit water. Overburden formations containing coarse, sorted particles are generally the most permeable and thus constitute the most important aquifers for the development of large water supplies. Silt and sand formations are less permeable but can constitute good sources of water for small supplies. The bedrock formations yield varying quantities of water due to irregular regional permeabilities of the formations.

A portion of the average annual precipitation of 35 inches enters the soil. Some of this is lost to evapotranspiration and the remainder becomes ground-water recharge. Recharge of ground-water reservoirs is greatest during the period from October to April when the effects of evapotranspiration are at a minimum, and is usually negligible during the remainder of the year. During the recharge period the precipitation amounts to about 21 inches, of which possibly 40 per cent or about 8.4 inches enters the soil depending on geology and topography. This is equivalent to a perennial ground-water supply of 340,000 gallons per day for every square mile of land. With an area of 634 square miles the total renewable ground-water supply of the County of Norfolk would be equivalent to approximately 216 million gallons per day. Only a small portion of this water is withdrawn by wells. A large part of the water goes to sustain base flow in streams.

3.2 SURFACE WATER

Introduction

The County of Norfolk is drained by two major watercourses which discharge to Lake Erie within the county; Big Creek, draining the west-central area, and the Lynn River, draining the eastern portion. A number of smaller watercourses, namely, Clear, Dedrich, Fishers, Hay and Young Creeks drain areas entirely within the county. Big Otter Creek, which discharges west of the county, drains a portion of the western extremity. The Grand River system drains a small area in the north-east corner. Nanticoke Creek, which discharges east of the county, drains a portion of the eastern extremity. A number of minor, unnamed streams, discharging directly to Lake Erie, complete the drainage of the county.

Surface water plays an important role in the county's economy, particularly from an agricultural standpoint. Soil moisture deficiencies during the growing season have forced many farmers to supplement precipitation with irrigation in order to ensure good crops. The development of economical, light-weight, portable irrigation systems has made it possible for the majority of tobacco growers, as well as vegetable and fruit growers, to practise irrigation. Consequently, irrigation has become, by far, the greatest of all water uses within the county and exerts a considerable demand on the resources of streams used for this purpose. The permit system* was introduced in 1961 to facilitate the management of water resources. This program has as its objective the fair sharing of the available supply, and the alleviation of serious interference.

At the end of the summer of 1963 there were 624 irrigators within the county whose takings from Lake Erie, streams and stream-fed sources were controlled by the permit system. The total amount of daily taking authorized by permit was approximately 178 mgd.

Only three municipalities in the county rely on surface sources for municipal water supply. A number of municipalities, industries and individuals discharge treated and untreated wastes directly to streams and Lake Erie in the county.

All watersheds in the county come under the jurisdiction of one of three conservation authorities which are active within the County of Norfolk.

In this chapter each of the main watercourses is discussed with respect to stream characteristics, streamflows, water quality and uses. Conservation authority activities are also outlined.

The drainage pattern of the county and streamflow-gauging stations are shown in Figure 3-1.

The sampling locations for water quality are shown in Figure 3-2.

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*Under Section 28a of The Ontario Water Resources Commission Act the taking of water in an amount in excess of 10,000 gallons per day, with few exceptions, requires authorization by permit.

3.2.1 LAKE ERIE

The county borders Lake Erie for approximately 40 miles (excluding Long Point). Since the decline of commercial fishing, the lake has not figured significantly in the economy of the county. Two municipalities rely on Lake Erie for municipal water supply and a number of irrigators withdraw directly from the lake. A limited number of commercial fishing vessels operate out of the lake ports. Recreational use of the lake includes fishing, swimming, boating, camping and hunting.

3.2.2 BIG CREEK

Description

Big Creek rises at a point almost 9 miles directly west of Harley (situated just north of the county boundary), flows in an easterly direction for some 11 miles, then in a southerly direction to Lake Erie passing through Teeterville, Delhi, Walsingham and Port Royal. The total fall over its 56-mile course is 428 feet, or 7.7 feet per mile.

The creek drains a total area of 281 square miles, of which approximately 206 square miles are within the County of Norfolk. The Big Creek watershed is bounded on the west by the Big Otter Creek and Thames River watersheds, on the north and north-east by the Grand River watershed and on the east by the Dedrich Creek and Lynn River watersheds.

The major tributaries of Big Creek are North, Venison and Cranberry Creeks, having drainage areas of 21, 34 and 7 square miles respectively.

Streamflow

There are four streamflow measuring gauges on Big Creek, three on the main stream and the other on North Creek. The main stream gauges are located near Delhi, Walsingham and south of Kelvin. The North Creek gauge is located at Delhi. In the summer of 1963 the manual gauge on Big Creek at Delhi was converted to an automatic gauge. The automatic recording gauge at Kelvin was installed in late 1963.

Two of the main stream gauges have continuous records from 1955 to date, the North Creek gauge from 1954 to date. Table 3-2 shows the maximum daily, average daily, average summer, minimum month, minimum 7-day and minimum daily flows

TABLE 3-2

BIG CREEK AND NORTH CREEK FLOWS

Water* Year Ending	Max. Day cfs	Avg. Day cfs	Avg. Summer[1] cfs	Min. Month cfs	Min. 7-Day cfs	Min. Day cfs
BIG CREEK NEAR WALSINGHAM - DRAINAGE AREA 228 SQ.MI.						
1963	953	163	93	68	45	43
1962	1,020	137	72	63	56	54
1961	695	158	119	99	96	93
1960	3,060	279	148	117	104	99
1959	828	209	109	75	62	60
1958	765	196	106	77	68	60
1957	985	219	163	141	112	106
1956	1,400	260	188	146	125	91
BIG CREEK NEAR DELHI - DRAINAGE AREA 140 SQ.MI.						
1963	635	90	39	32	19	14
1962	886	83	46	34	26	18
1961	364	92	68	45	31	25
1960	4,910e	175	69	43	37	34
1959	783	120	52	27	13	10
1958	740	117	54	39	25	15
1957	1,060	132	69	61	39	32
1956	1,630	178	108	66	20	6
NORTH CREEK AT DELHI - DRAINAGE AREA 21 SQ.MI.						
1963	108	13	6	4	2	1
1962	239	15	7	6	2	0
1961	105	17	14	9	6	4
1960	1,000	27	11	7	5	4
1959	119	16	8	6	3	2
1958	127	18	8	6	5	3
1957	153	20	16	14	9	7
1956	360	26	16	15	7	7
1955	511	25	9	8	7	6

* Water Year - a twelve month period from October 1 to September 30 inclusive.

1 - average for June, July, August and September

e - estimated

for the period of record for each of the three gauges.

Water Quality

The water quality of Big Creek, upstream from the Town of Delhi is satisfactory. Reference should be made to Table 3-3.

The following summary of results obtained over the past four years would indicate that significant increases in bacteriological contamination are experienced as the stream passes through Delhi.

Sampling Point No.	Location		5-Day BOD (ppm)	M.F.Coliform Count per 100 ml
B 31.8	One mile upstream from Delhi	Median	---	30
		Average	1.5	--
		Maximum	2.4	6,800
		Minimum	0.8	0
		No.of Samples	5	5
B 29.9	Downstream from Delhi	Median	---	8,003
		Average	1.7	--
		Maximum	2.6	26,000
		Minimum	1.0	66
		No.of Samples	4	4

This pollution is caused by the effluent from the water pollution control plant and from various drainage systems in the town.

Uses

Although limited to a short period each year, the irrigation of tobacco represents the greatest use of the stream. It is estimated that 345 irrigators make withdrawals in amounts totalling 103 mgd*.

* This figure represents the amount of water authorized for withdrawal under permit system. It does not necessarily represent actual daily withdrawals since all irrigators would not irrigate on the same day. Normally irrigation is employed for about three periods a growing season. Since this figure includes water taken from stream-fed storage reservoirs as well as directly from the stream, the direct effect on streamflow is reduced.

TABLE 3-3

SAMPLE RESULTS - BIG CREEK - COUNTY OF NORFOLK

Sampling Point No.	Location	Date	5-Day BOD ppm	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
B 43.9	Big Creek - at Brant County Line	April 10/63 Oct. 8/63	2.4 1.4	1.4 2.6	- Trace	40 160
B 41.0	Big Creek - at Conc.#3 Windham Twp.	April 10/63 Oct. 8/63	1.7 0.9	1.1 1.4	- Trace	52 120
B 39.1	Big Creek - below Teeterville	April 10/63 Oct. 8/63	2.1 1.1	1.5 0.6	- 0.0	140 300
B 35.7	Big Creek - at Conc. #7 Windham Twp.	April 10/63	2.0	1.1	-	100
B 31.8	Big Creek - one mile north of Delhi	April 10/63 Oct. 8/63	2.0 1.3	1.3 0.5	- 0.0	30 80
B 30.7	Big Creek - at Highway #3	April 10/63 Oct. 8/63	2.1 1.1	1.4 0.7	- 0.0	100 70
B 30.6	Big Creek - at Delhi	April 10/63 Oct. 8/63	2.2 1.9	1.8 1.1	- 0.0	31,000 21,000

TABLE 3-3 - Cont'd

SAMPLE RESULTS - BIG CREEK - COUNTY OF NORFOLK

Sampling Point No.	Location	Date	5-Day BOD ppm	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
B 29.9	Big Creek - south of Delhi	April 10/63	1.7	1.7	-	26,000
		Oct. 8/63	1.7	1.3	0.1	15,900
B 25.9	Big Creek - at Conc.#11 - North Walsingham Twp.	April 10/63	2.5	3.8	-	750
		Oct. 8/63	1.7	1.1	0.1	800
B 21.4	Big Creek - at Conc.#10 - North Walsingham Twp.	April 10/63	2.4	9.0	-	970
		Oct. 8/63	1.6	1.8	Trace	600
B 13.5	Big Creek - at Langton Road	April 10/63	2.3	10.0	-	30,000
		Oct. 8/63	1.3	2.6	Trace	140
B 10.9	Big Creek - at Conc.#5 - South Walsingham Twp.	April 10/63	3.2	9.5	-	21,000
		Oct. 8/63	1.1	2.0	0.0	230
B 2.4	Big Creek - below Port Royal	April 10/63	2.2	16.0	-	17,000
		Oct. 8/63	1.1	6.0	Trace	210
B 0.3	Big Creek - at Long Point Road	April 10/63	2.1	11.5	-	37,000
		Oct. 8/63	2.1	10.5	Trace	110

The Town of Delhi uses North Creek as its main source of water supply. At times of low flow in the creek, water is diverted from Big Creek. Plans are underway to construct a dam and reservoir at the site of the water works to provide additional water for municipal supply.

A grist mill, located in Delhi, utilizes Big Creek water as its source of power.

Limited recreational use is made of Big Creek and its tributaries. Fishing, boating, and swimming to a lesser extent, are the main recreational activities.

The Delhi water pollution control plant effluent is discharged to Big Creek.

3.2.3 LYNN RIVER

Description

The Lynn River and its tributaries drain an area of 109 square miles, all within the County of Norfolk. Its major tributaries are Patterson, Black and Kent Creeks.

At one time the entire stream was called Patterson Creek but now the stretch from Simcoe to Lake Erie is referred to as the Lynn River; from Simcoe to the headwaters near Windham Centre the stream is referred to as Patterson Creek. Patterson Creek has a drainage area of approximately 31 square miles. Black Creek, which drains about 47 square miles, joins the Lynn River at Port Dover approximately one-half mile upstream from the river's mouth.

Streamflow

There are two streamflow measuring gauges on the Lynn River. One is a manual gauge located at the south limits of Simcoe; the other is an automatic recording gauge located north of Simcoe on Patterson Creek. The former gauge was installed in 1957 and the latter in September 1963.

Records are available for the manual gauge from 1957 to date. Table 3-4 shows the maximum daily, average daily, average summer, minimum monthly, minimum 7-day and minimum daily flows for the period of record for the Lynn River gauge. The drainage area above this gauge is 55 square miles.

TABLE 3-4

LYNN RIVER FLOWS

Water Year Ending	Max. Day cfs	Avg. Day cfs	Avg. Summer cfs	Min. Month cfs	Min. 7-Day cfs	Min. Day cfs
1963	511	37	25	16	8	4
1962	759	33	17	16	9	4
1961	276	42	35	16	10	3
1960	881	59	36	25	23	6
1959	706	58	28	23	20	10
1958	247	52	36	25	18	8

Water Quality

The water quality of the Patterson Creek section of the river is in general satisfactory. Deterioration is evident as the stream flows through Simcoe (Table 3-5). This has been attributed to the discharge of the effluent from the water pollution control plant and storm drains in the town.

A natural recovery from pollution is noted as the stream progresses through the Township of Woodhouse (Table 3-5). The water quality again deteriorates as the stream flows through the Port Dover area. Degraded conditions are evident at the mouth of the stream. Pollution of domestic and industrial origin results in the severe deterioration of the Lynn River at its point of entrance to Lake Erie.

Uses

The Lynn River and its tributaries are used extensively for the irrigation of tobacco, vegetable and fruit crops. Forty-one irrigators have permits to withdraw about 9.5 mgd* directly from the stream during the irrigation season.

The river is used to dilute the effluent from the Simcoe WPCP.

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* See foot note page 22

TABLE 3-5

SAMPLE RESULTS - LYNN RIVER - COUNTY OF NORFOLK

Sampling Point No.	Location	Date	5-Day BOD ppm	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
LPB 11.9	Lynn River - Bloomsburg branch south of Bloomsburg	April 9/63 Oct. 8/63	2.9 2.3	1.7 2.3	0.0 Trace	170 -
LPB 10.3	Lynn River - Bloomsburg branch south of C.N.R.	April 9/63 Oct. 8/63	2.6 1.2	2.3 2.1	0.0 Trace	750 -
LP 11.4	Patterson Creek - Conc.#13 - Windham Township	April 9/63 Oct. 8/63	1.6 1.0	2.5 9.5	0.0 Trace	70 -
LP 9.8	Patterson Creek - Norfolk St. bridge - Simcoe	April 9/63 Oct. 8/63	2.4 2.0	3.1 2.9	0.0 Trace	380 -
LK 9.9	Kent Creek - at Cedar St. - Simcoe	April 9/63 Oct. 8/63	2.2 1.2	2.3 -	0.0 Trace	27 260
L 9.4	Lynn River - at Norfolk St. bridge - Simcoe	April 9/63 Oct. 8/63	2.1 1.6	2.8 3.5	0.0 Trace	270 37,000

TABLE 3-5 - Cont'd

SAMPLE RESULTS - LYNN RIVER - COUNTY OF NORFOLK

Sampling Point No.	Location	Date	5-Day BOD ppm	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
LK 9.3	Lynn River - at Colborne St. bridge (Junction with Kent Creek)	April 9/63	2.0	2.1	0.0	190
		Oct. 8/63	1.0	5.0	Trace	1,460
L 8.8	Lynn River - at Argyle St. bridge - Simcoe	April 9/63	2.3	2.3	0.0	950
		Oct. 8/63	1.6	3.6	Trace	11,000
L 7.8	Lynn River - south of Simcoe - at C.N.R. bridge	April 10/63	12.0	2.6	0.3	5,600
		Oct. 8/63	4.1	2.9	0.4	56,000
L 5.7	Lynn River - at Conc.#3 - Woodhouse Township	April 10/63	4.6	2.8	0.2	490
		Oct. 8/63	3.9	4.0	0.4	13,000
L 2.2	Lynn River - above Silver Lake (Port Dover)	April 10/63	3.1	2.6	0.2	2,800
		Oct. 8/63	1.1	1.7	0.3	730
L 1.2	Lynn River - below Silver Lake	April 10/63	2.8	10.0	0.2	370
		Oct. 8/63	4.6	6.0	0.4	640

TABLE 3-5 - Cont'd

SAMPLE RESULTS - LYNN RIVER - COUNTY OF NORFOLK

Sampling Point No.	Location	Date	5-Day BOD ppm	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
L 1.0	Lynn River - below Kolbe Co. outfall - Port Dover	April 10/63 Oct. 8/63	5.2 54.0	20.0 -	0.2 0.3	78,000 890,000
L 0.4	Lynn River - at lift bridge - Port Dover	April 10/63 Oct. 8/63	5.3 22.0	9.5 12.5	0.2 0.6	26,000 171,000
L 0.6	Lynn River - below Brant St. storm sewer outfall	Oct. 8/63	6.6	8.5	0.2	148,000
L 0.1	Lynn River - at Port Dover Harbour	April 10/63 Oct. 8/63	5.2 6.0	10.5 9.0	0.2 0.2	29,000 132,000
LB 0.9	Black Creek - above junction with Lynn River - Port Dover	April 10/63 Oct. 8/63	2.7 3.0	38.0 17.0	0.1 0.1	80 30,000
LB 1.0	Black Creek - at end of Vale St. - Port Dover	Oct. 8/63	4.6	20.0	0.2	25,000

One industry, in the Port Dover area, withdraws water directly from the Lynn River for cooling. A number discharge untreated wastes directly to the river throughout its course.

Cattle farmers rely on the river for livestock water and related farm use.

3.2.4 DEDRICH CREEK

Description

The headwaters of Dedrich Creek rise in the area of Silver Hill. The creek flows southerly from there to Lake Erie, where it discharges near Port Rowan. It falls some 200 feet in its 14-mile course, averaging slightly more than 14 feet per mile. The watershed, draining an area of approximately 32 square miles, lies immediately east of the Big Creek watershed. The main tributary of Dedrich Creek is Mud Creek, which drains an area of 11 square miles and has a length of 8 miles.

Streamflow

An automatic recording gauge was installed in September 1963 on the main stream.

Uses

The prime use of Dedrich Creek is for irrigation, tobacco being chief among the irrigated crops. It is estimated that 21 irrigators, including one golf course and one market garden, withdraw water from the stream and stream-fed sources in amounts approximating 4.7 mgd*.

A number of dairy farmers use the stream for watering livestock.

3.2.5 NANTICOKE CREEK

Description

The headwaters of Nanticoke Creek rise in the north-west corner of the Township of Windham. From the headwaters the stream flows southerly for 6 miles to the Town of Waterford, easterly for 7 miles and then southerly again, discharging to Lake Erie in the adjacent County of Haldimand approximately

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* See foot note page 22

2 miles east of the county boundary. The total length of the creek is 27 miles, with a total fall of slightly over 200 feet, an average gradient of almost 8 feet per mile. The creek drains an area of approximately 71 square miles, of which 60 square miles are located within the county. The watershed lies immediately east of the Lynn River watershed and drains the most easterly portion of the county. There is no streamflow measuring gauge on the creek.

Water Quality

The water quality of Nanticoke Creek upstream from the Waterford area is satisfactory. Deterioration is evident, however, as the stream passes through the Town of Waterford (Table 3-6).

A major cause of impaired water quality in this section is runoff and seepage from the municipal refuse disposal area located immediately upstream from Waterford (Sampling Point No. N 24.8). Other causes have stemmed from the discharge of untreated and inadequately treated waste from industrial, domestic, and commercial sources.

Additionally, deterioration of water quality in the Co-operative Branch of Nanticoke Creek is evident. This impairment is caused by the release of inadequately treated waste from the Villa Nova Milk Products Co-operative processing plant (Sampling Point NCO 18.6).

Uses

Irrigation is widely practised. Twelve irrigators withdraw an estimated 3.3 mgd* for this purpose. A number of dairy farmers use the stream for livestock watering. At least one industry discharges untreated waste to the stream. The stream will receive the effluent from the Waterford sewage lagoon project.

3.2.6 YOUNG CREEK

Description

Young Creek drains an area of slightly more than 22 square miles of the south-central portion of the county. It rises approximately 2.5 miles north-west of the hamlet of Walsh and flows generally in a south-easterly direction to Lake Erie. It has a total fall of slightly more than 200 feet in its 11-mile length, an average fall of approximately 19 feet per mile.

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* See foot note page 22

TABLE 3-6

SAMPLE RESULTS - NANTICOKE CREEK - COUNTY OF NORFOLK

Sampling Point No.	Location	Date	5-Day BOD ppm	Turbidity in Silica Units	Anionic Detergents as A B S (ppm)	M.F. Coliform Count per 100 ml
N 29.4	West of Vanessa Station	Oct. 11/63	1.3	9.0	Trace	380
N 25.8	Waterford Pond above Conc.#7 Townsend Township	April 24/63	3.1	7.5	-	7,000
		Oct. 11/63	3.0	2.1	Trace	90
N 24.8	Upstream from Waterford	Oct. 11/63	12.0	8.0	0.0	16,000
N 24.7	Centre of Waterford	Oct. 11/63	6.7	9.0	Trace	2,800
N 24.6	Above dam - west of Hwy.#24	Oct. 11/63	8.9	6.0	0.1	6,900
N 24.4	Below Waterford Dam	Oct. 11/63	3.2	8.0	0.1	51,000
		April 24/63	5.8	8.5	-	17,000
NCO 18.6	Co-operative Creek below Villa Nova	April 24/63	5.8	8.5	-	6,300
		Oct. 11/63	49.0	0.4	-	186,000

TABLE 3-6 - Cont'd

SAMPLE RESULTS - NANTICOKE CREEK - COUNTY OF NORFOLK

Sampling Point No.	Location	Date	5-Day BOD ppm	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
NV 18.3	Villa Nova south of Railway	April 24/63	2.4	6.5	-	1,600
N 17.8	At Villa Nova Road	Oct. 11/63	2.9	-	0.1	7,000
N 16.3	At Conc.9 Townsend Township	April 24/63	3.6	7.0	-	550
		Oct. 11/63	2.9	-	0.1	220

Streamflow

The installation of an automatic recording gauge on the stream just south-east of the Police Village of Vittoria was completed in September 1963.

Uses

An extensive use of Young Creek is for irrigation. It is estimated that twenty-four irrigators withdraw up to 5.8 mgd* from the stream and stream-fed sources. A number of dairy farmers depend to some extent on the stream for watering livestock.

3.2.7 BIG OTTER CREEK

Description

The Big Otter Creek watershed lies for the most part to the west of the County of Norfolk but drains an area of approximately 42 square miles of the western portion of the county. The main branch drains an area of approximately 6 square miles, while a major tributary, Little Otter Creek, drains the remaining 36 square miles.

Streamflow

The stream is not gauged within the county. Automatic gauges have been installed on the main stream near Vienna and on Little Otter Creek west of Straffordville (in late 1963). Both of these are within the adjacent County of Elgin. Significant figures are not available for the County of Norfolk.

Water Quality

The water quality of Little Otter Creek is somewhat deteriorated in the Courtland area:

Sampling Point No.	Location	5-Day BOD ppm	M.F. Coliform Count per 100 ml
OL 25.7	Upstream from Courtland	1.9	380
OL 24.8	Downstream from Courtland	2.1	19,000

* See foot note page 22

This increase in pollution is attributed to the discharge of inadequately treated wastes through surface-water drains into Little Otter Creek.

Uses

Forty-eight irrigators withdraw about 14.8 mgd* from the stream. Forty are located on Little Otter Creek and the remainder on the main stream and its minor tributaries. Big Otter Creek provides dilution for the effluent from the Tillsonburg WPCP situated just north of the county boundary.

3.2.8 SOUTH OTTER CREEK

Description

This is a small stream which drains a minor portion of the south-west section of the county. Its total drainage area is approximately 43 square miles, of which 24 are within the county.

Uses

About 12.4 mgd* are withdrawn from the stream by 42 tobacco crop irrigators.

3.2.9 McKENZIE CREEK

Description

Approximately 29 square miles of the north-east portion of the county are drained by the Grand River tributary, McKenzie Creek and its tributary, Boston Creek. There is no streamflow measuring gauge on these streams.

Uses

McKenzie Creek is important from the standpoint of irrigation as it flows through tobacco lands as well as lands used for the growth of fruit and vegetables. It is estimated that 20 irrigators withdraw water directly from the stream at rates approximating 5.8 mgd*. Two of three grist mills located within the watershed use water power. The associated head ponds are used by local residents for boating, swimming and fishing.

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* See foot note page 22

3.2.10 MINOR WATERCOURSES

Clear, Fishers and Hay creeks are three important smaller streams. Clear Creek drains an area of approximately 27 square miles of the south-west portion of the county, and Fishers and Hay creeks drain about 4 and 12 square miles respectively of the lakeshore area south of Simcoe.

Irrigation use approximates 11.7 mgd* from Clear Creek by 41 irrigators; 3.4 mgd* from Fishers Creek by 12 irrigators; and 3.2 mgd* from Hay Creek by 10 irrigators.

3.3 CONSERVATION AUTHORITIES

3.3.1 Big Creek Region Conservation Authority

The Authority has jurisdiction over most of the streams in the county. The total region covers an area of 610 square miles and is bounded by the following watersheds; on the west by the Otter Creek, on the north by the Thames River and Grand River, and on the east by the Sandusk Creek.

The region is comprised of a number of smaller drainage areas, the most important being the Big Creek and Lynn River watersheds. Others are: Clear, Dedrich, Young, Fishers, Hay and Nanticoke creeks. In addition there are a number of unnamed, minor creeks draining directly into Lake Erie.

The Conservation Branch of the former Department of Planning and Development recommended, in part, in the 1958 Big Creek Region Conservation Report that the Authority:

- set up an Advisory Committee on Pollution Control,

- support the present work of the Ontario Water Resources Commission and the Department of Lands and Forests in pollution control by publicizing the present conditions and the need for co-operation by every individual and industrial company.

- establish ground-water observation wells for the study of the North Creek water table fluctuations.

- encourage the dissemination of irrigation "know-how" among the farmers concerned.

- assist in the proper location and construction of farm ponds.

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* See foot note page 22

- give early consideration to the construction of a dam on North Creek.

- construct a series of community ponds throughout the watershed.

3.3.2 Otter Creek Conservation Authority

This Authority has jurisdiction over the Big Otter Creek watershed and those smaller watersheds which drain to Lake Erie from the east boundary of the Big Otter Creek watershed to the west boundary of the Big Creek Region. The total Otter Creek Conservation Authority area is 273 square miles of which approximately 65 square miles are within the County of Norfolk.

The Otter Creek Conservation Report 1957, recommended in part that the Authority undertake the following measures.

- Conservation storage reservoirs be considered in order to regulate the spring runoff and store water for use during the drier summer months.

- A detailed ground-water study be made to determine the potential water yield from this source.

- An extensive education programme concerning pollution control be directed to both individuals and corporations. This should include the need for prevention of the dumping of refuse along the edges of or into the rivers.

- A pollution advisory board be formed within the Authority.

3.3.3 Grand Valley Conservation Authority

The Grand Valley Conservation Authority has jurisdiction over an area of approximately 29 square miles in the north-east corner of the County of Norfolk. This area is drained by the Grand River tributaries, McKenzie and Boston Creeks.

The Authority has a broad programme of flood control and water conservation projects for the Grand Valley but

none is scheduled to be constructed on the tributaries within the County of Norfolk.

3.4 CONCLUSIONS

The importance of surface water in the economy of the county indicates that measures are necessary to ensure its availability for use when required.

Conservation storage of water would meet this objective and alleviate difficulties associated with conflict of use.

Similarly, in certain areas ground-water resources offer additional sources of supply. The OWRC is prepared to assist municipalities in ground-water surveys to develop potential supplies.

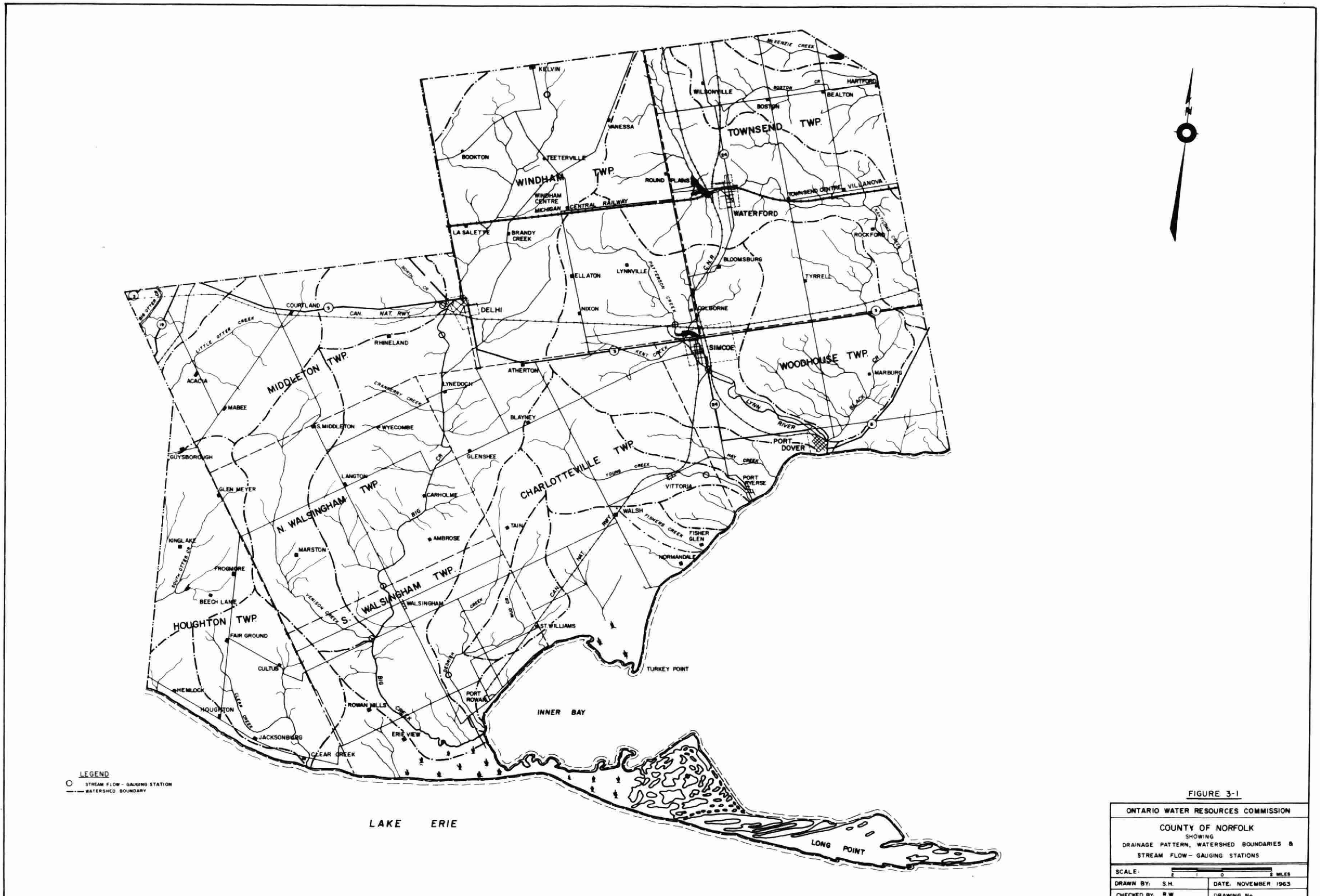


FIGURE 3-1

ONTARIO WATER RESOURCES COMMISSION

COUNTY OF NORFOLK
SHOWING
DRAINAGE PATTERN, WATERSHED BOUNDARIES & STREAM FLOW- GAUGING STATIONS

SCALE: 2 1 0 2 MILES	
DRAWN BY: S.H.	DATE: NOVEMBER 1963
CHECKED BY: R.W.	DRAWING No.

LEGEND

LK-9.3 SAMPLING POINT SHOWING STREAM AND MILEAGE

FIGURE 3-2

ONTARIO WATER RESOURCES COMMISSION

COUNTY OF NORFOLK
SHOWING
STREAM SAMPLING POINTS

SCALE: MILES	
DRAWN BY: S.H.	DATE: NOVEMBER 1963
CHECKED BY: R.W.	DRAWING No.

CHAPTER 4

TOWN OF SIMCOE

CHAPTER 4

TOWN OF SIMCOE

4.1 WATER SUPPLY

4.1.1 Existing Facilities and Present Water Usage

SOURCES

Water supply is obtained from four ground-water sources which include three deep wells and a system of collection galleries.

Cedar St. Collection Galleries

The Cedar St. galleries were established in 1907. Water is collected by a network of piping galleries which extend over an an area of about 9 acres. The galleries vary in depth from 9 to 12 feet and consist of 18-inch weeping tiles which terminate at concrete sumps. The associated catchment area is 50 acres. A small stream (Kent Creek) has been dammed to augment the ground-water level in the gallery area.

The Cedar St. galleries are estimated to have a capacity of 1,400 gpm (2.02 mgd).

The pumping station is operated intermittently. Two 8 inch diameter feeder mains deliver water directly into the distribution system.

Chapel St. Well

This well, which is 64 feet deep with a 14 inch casing, was drilled in 1939. It has a rated capacity of 575 gpm (0.83 mgd).

First Avenue Well

The well was developed in 1948 and is of gravel-wall construction, 39 feet in depth. This source is rated at 600 gpm (0.86 mgd).

Wellington St. Well

The gravel-wall well was constructed in 1937 and is 33 feet deep. The well is rated at 325 gpm (0.47 mgd), but

is normally used as a reserve source as treatment for iron removal is required.

Water Quality

Normally the bacteriological quality of these sources is satisfactory. However in November 1963, adverse samples were encountered in the system and a boil order was issued by the medical officer of health. Subsequent reports indicated satisfactory conditions and the boiling requirement was terminated. However, continued vigilance is being maintained. Where continued bacteriological contamination occurs in a water supply system, sound sanitary engineering practice requires that disinfection be employed continuously.

To date, the water from all the sources has not required chlorination. However, the occurrence of slime and algae growths in the Cedar St. collection galleries and the apparent connection between the galleries and Kent Creek has prompted the OWRC to recommend that this source be used as a reserve only, and that the water from this source be chlorinated whenever it is necessary to pump it into the distribution system.

The average results of five chemical analyses of the water from the four sources is as follows:

Location	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride as Cl	pH at Lab.	Fluoride as F
Cedar St. well	227	193	0.01	8	7.5	0.1
First Ave. well	293	243	0.11	9	7.6	0.0
Chapel St. well	229	191	0.01	7	7.8	0.0
Wellington St. well (treated)	250	250	0.16	4	7.5	-

Test wells have been drilled in the vicinity of the Cedar St. collection galleries. The results of chemical analysis of water from the test area are given on the following page.

Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride as Cl	pH at Lab.	Fluoride as F
214	180	0.29	11	8.0	0.1

Treatment

Aeration and filtration are provided at the Wellington St. well for iron and hydrogen sulphide removal.

Storage and Distribution System

Storage on the system is provided by a 500,000 gallon elevated tank located at the end of Union St.

The distribution system consists of 28 miles of water mains. Pipe sizes vary from 2 inches to 16 inches in diameter. There are also 118 hydrants throughout the system.

Water Usage

At the present time water is being supplied to 2,783 individual services in the town, of which 2,383 are domestic and 400 are commercial. All services are metered.

The following is a table showing the water consumption figures for the town during the year 1962 and to October in 1963.

Period	1000's of Imperial Gallons	
1962	Total	Average Day
January	26,933.3	867
February	25,336.0	905
March	27,382.3	882
April	24,479.3	816
May	29,175.6	940
June	32,362.5	1,078
July	36,779.7	1,184
August	32,365.9	1,040
September	30,732.3	1,025
October	32,829.7	1,060
November	33,224.8	1,120
December	28,693.6	959
TOTAL	360,295.0	1,015

Period 1963	1000's of Imperial Gallons Total	Average Day
January	31,097.7	1,001
February	30,758.1	1,009
March	29,586.9	952
April	26,220.7	878
May	29,291.2	945
June	34,314.6	1,142
July	36,128.9	1,162
August	26,409.6	851
September	30,207.5	1,008
October	32,783.8	1,063

The maximum pumpages during 1962 and 1963 occurred on the following days.

Date	Pumpage (Gallons)
June 26, 1962	1,652,740
June 24, 1963	1,654,830

The combined rated capacity of the four sources is 4.18 mgd which is sufficient to meet the current demands.

4.1.2 Potential Additional Supplies

Ground Water

The present water supplies are obtained from two types of aquifers; one in the shallow surface sand, and the other in sand and gravel in the overburden.

The Cedar St. supply obtains water from the surface sand deposit which extends westward from the town limits. The test wells have recently been drilled in the same area south of the collections galleries to determine whether additional water can be taken from this deposit without affecting the production of the galleries.

The Simcoe wells are located in a glacio-fluvial spillway channel which parallels the present Lynn Valley. Deposits in this channel appear to contain sand and gravel layers interbedded with clays. Extensive test drilling carried out in the channel within the town has resulted in the development of four wells. When additional water supplies are needed, future ground-water surveys and test drilling should be carried out in this valley and extended beyond the present town limits in a south-easterly direction toward Lake Erie.

Surface Water

If required, the Lynn River could be used as a water source. However, water from the river would require treatment, and be subject to seasonal variation in flow. As groundwater supplies are plentiful in this area, it does not appear that the use of a surface-water supply will be necessary.

4.1.3 Future Requirements

The expected population of the Town of Simcoe based on the prediction in Section 2.1.5, Chapter 2, will be in the vicinity of 13,000 persons by the year 1980.

During the year 1962, a total of 360,295,595 gallons of water were pumped representing a per capita consumption of 114 gpd.

There is a generally recognized trend in North America to an increasing use of water for all purposes. Current practice is to allow an amount of 0.5 gpcpd increase for each future year in predicting future demands. Therefore, based on this criterion, the average water demand in 1980 would be 123 gpcpd or 1.6 mgd with a maximum demand of 3.2 mgd. As the rated capacity of the system is 4.18 mgd and additional sources are also being explored, it appears likely that the current system will be capable of supplying these needs.

4.2 WATER POLLUTION

4.2.1 Water Pollution Control Projects

4.2.1.1 Municipal

General

The municipal water pollution control plant was extended in 1963 to provide improved treatment. The new facilities include: improved grit removal, barminution, sludge digestion, and additional sedimentation, aeration, and additional chlorination facilities. The plant operation was assumed by the OWRC after the extensions were completed. The design capacity of the old and new sections of the plant are 0.6 mgd and 1.4 mgd respectively. The present facilities are designed to treat a sewage flow of 2.0 mgd or waste from an equivalent population of 15,000 persons. The treated effluent is discharged to the Lynn River.

Treatment Efficiency

A brief summary of plant efficiency during the period from January 1962 to June 1963 inclusive follows:

	BOD				Suspended Solids			
	Avg.	Max.	Min.	%Removal	Avg.	Max.	Min.	%Removal
Raw Sewage	220	520	65	-	447	866	162	-
Final Effluent	28	46	11	87.3	35	72	10	92.2

Sewage Flow

The following table shows the sewage flow recorded at the plant from January 1962 to June 1963 inclusive.

	1000's of Gallons			
Period	Total	Max.Day	Min.Day	Avg.Day
1962				
January	29,322	1,080	833	946
February	25,509	1,147	718	912
March	28,329	1,682	660	914
April	26,877	1,261	739	895
May	27,224	1,165	707	880
June	25,230	957	702	843
July	27,221	1,117	666	879
August	31,041	1,116	793	1,001
September	30,182	1,189	834	1,004
October	31,901	1,121	887	1,025
November	32,643	1,410	805	1,089
December	32,014	1,250	864	1,035
1963				
January	29,085	1,033	800	940
February	23,455	971		
March	32,659	1,390	734	1,051
April	32,643	1,636		
May	33,386	1,263	791	1,075
June	28,203	1,128		

During 1962 it is evident that the old section of the plant was overloaded.

Operating Difficulties

Problems have been experienced with wide variations of hydraulic and organic loading at the older plant. It is anticipated that these problems will be alleviated with the improved treatment facilities.

4.2.1.2 Refuse Disposal

Refuse is disposed of by the sanitary landfill method. The disposal site is located north-west of town on the north bank of Patterson Creek.

Seepage and runoff from the disposal area may occur during periods of heavy rains and spring floods. Recent samples of the river collected downstream from the landfill area were satisfactory.

4.2.1.3 Industrial Wastes

Only seven of the industries in Simcoe use appreciable volumes of water. Three of these use the water essentially for cooling or the production of steam.

These industries utilize approximately 60 per cent of the town's water supply and accordingly contribute a large part of the total sewage treated. The estimated total industrial waste volume averages about 300,000 gallons per day. This is subject to considerable variation due to the seasonal nature of several of the food processing plants. For the same reason, the character of the wastes received at the WPCP will show wide fluctuations.

Information on water consumption, the manner in which the water is used and the nature and disposal of the wastes is provided for the significant industries following.

AMERICAN CAN COMPANY

The American Can Company makes tin plated containers. They receive an average of 81,500 gallons per day from the Simcoe PUC. This water is used mostly for boiler make-up and cooling purposes. Except for its elevated temperature, this water is essentially uncontaminated, and is directed to the sanitary sewer.

Normally, uncontaminated flows such as cooling waters can be discharged directly to a stream without treatment as such flows would impose an unnecessary hydraulic load

on sewage works. Arrangements should be made to direct this flow to a stream or drainage channel if practicable. This water quality should conform to the Commission's objectives for discharges to surface waters.

CANADIAN COUPLINGS AND FITTINGS LIMITED

This company makes pipe fittings which are given an alkaline cleaning and are plated. An average of 2,470 gpd of water is supplied by the PUC. The effluent, which contains plating and cleaning rinses, discharges to the Lynn River. At the time of the survey, the effluent had a high pH and high cyanide content. The company is investigating a method to destroy the cyanide by oxidation with chlorine. A small soluble oil discharge is dumped in a pit at the rear of the plant. A typical analysis of the total effluent is as follows:

Suspended Solids	=	247 ppm
pH	=	10.1
Cyanide as HCN	=	49 ppm
Caustic Alkalinity	=	162 ppm
Ether Solubles	=	190 ppm
Zinc	=	2.4 ppm

CANADA WIRE AND CABLE

This company produces wire for electromagnets and uses an average of 28,000 gpd for cooling purposes. Much of the water is recirculated; the effluent is discharged to the municipal sanitary sewer. Solid wastes are burned at the town dump. If possible, uncontaminated cooling water should be discharged to a stream or drainage channel to prevent unnecessary hydraulic load on municipal sewage works.

CANADIAN CANNERS

Canned foods are produced in this plant. The PUC supplies the company with an average of 73,000 gpd, which is used for process water and steam. These wastes which are high in solids and BOD are discharged to the municipal sanitary sewers after pretreatment to reduce the solids. In addition, the company draws an average of 144,000 gpd from a private well for cooling purposes and the effluent is discharged to storm sewers.

BROOK WOOLLEN COMPANY LIMITED

This company produces yard goods from cotton and wool. Production has dropped over the past several years due to

the increased use of synthetics. The PUC supplies an average of 45,000 gpd. The waste effluent, which is contaminated with dyes and highly coloured, flows through a settling basin into the Lynn River. When sampled the waste discharge characteristics exceeded the Commission's objectives. The preferred long-term solution to waste disposal at this plant would be a connection to the municipal sewerage system.

ST.WILLIAMS FROZEN FRUITS LIMITED

Fruit is frozen and preserved in season by this company. Sulphur dioxide is used in the process of preservation and an average of 35,000 gpd of water is required for cooling and washing purposes. The liquid wastes contain sulphur dioxide and fruit juices, the both of which would have a considerable COD and BOD content. This effluent discharges to the Lynn River at present; however, a connection to the sanitary sewer is expected to be made for the 1964 season.

ST.WILLIAMS PRESERVES

This company uses fresh fruit to make jams and jellies. In the process sulphur dioxide is used as a preservative. The water usage averages 40,000 gpd. This is supplied by the PUC for use in steam, washing and cooling. The liquid wastes, contain traces of sulphur dioxide and have a moderate BOD. Municipal sewer connections will be installed before the next canning season.

MORSE CHAIN OF CANADA LIMITED

This industry does assembling and flame hardening of metal products. An average of 8,200 gpd of water is supplied by the PUC. A vapour degreaser is employed to remove grease from parts, and as a result, there is little or no industrial waste, other than cooling water. This is discharged to the sanitary sewer. Although in this case the flow is not a great amount, it is not customary to discharge uncontaminated cooling waters to storm or natural drainage systems.

LYNN VALLEY PACKERS

This is a slaughter house which does custom killing of cattle and hogs. About 17 hogs are killed per week. An average of 150 gpd is drawn from a well for a daily clean-up. Blood is buried in a field; solid wastes are processed by Darlings and Company; and the liquid wastes, which have a

high BOD, solids and fat content, are released to a septic tank.

SIMCOE LEAF TOBACCO COMPANY LIMITED

The production of tobacco is seasonal. This fact is reflected by an average water usage of 27,000 gpd during January to May, and only 2,340 gpd from July to September. Water is used mostly for steam in the redrying of tobacco. Sanitary wastes and boiler blowdown are discharged to the sewer.

SHELL CANADA LIMITED

This is a dry industry which prepares pesticides and herbicides. All dry wastes are hauled to the municipal refuse disposal site.

4.2.2 Surface Water Quality and Major Sources of Pollution

The water quality of Patterson Creek, Kent Creek and the Lynn River is indicated in Table 4-1. Attention is directed to the deterioration of water quality as the river progresses through the town.

The situation results from the discharge of inadequately treated domestic, industrial and food processing wastes to the watercourse. Such wastes are being discharged illegally to some of the municipal storm sewers, surface ditches and private drains which enter the stream.

The locations of known outlets are indicated on the accompanying map and the laboratory analyses of outlet samples collected are listed in Table 4-2. Several drains were submerged; others were not flowing.

It is expected that the completion of sanitary and interceptor sewers will reduce the amount of untreated wastes being discharged to the Lynn River.

4.2.3 Future Requirements

Sufficient capacity is available for anticipated population increases.

TABLE 4-1

SAMPLE RESULTS - LYNN RIVER - SIMCOE SECTION

Sampling Point No.	Location	5-Day BOD (ppm)	Total Solids (ppm)	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
LP 11.4	Patterson Creek - upstream from Simcoe	1.0	342	9.5	Trace*	70
LP 9.8	Patterson Creek - Norfolk St. bridge	2.0	286	2.1	Trace	380
L 9.4	Lynn River - at Norfolk St.	1.6	308	3.5	Trace	37,000
LK 9.9	Kent Creek at Cedar St.	1.2	316	-	Trace	260
LK 9.3	Kent Creek at Colborne St.	1.0	392	5.0	Trace	1,460
L 8.8	Lynn River - at Argyle St.	1.6	320	3.6	Trace	11,000
L 8.4	Lynn River - at Oakwood St.	1.4	332	2.3	0.3	25,000
L 7.8	Lynn River - south of Simcoe	4.1	350	2.9	0.4	56,000

*Trace = less than 0.1

TABLE 4-2

SAMPLE RESULTS - STORM AND WASTE WATER OUTLETS - TOWN OF SIMCOE

Sampling Point No.	Location	5-Day BOD ppm	Solids (ppm) Total	Susp.	Diss.	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
L 9.82W	Norfolk St. N. N.W. of bridge	NO FLOW AT TIME OF INSPECTION					
L 9.81W	Norfolk St. W. south side under bridge	NO FLOW AT TIME OF INSPECTION					
L 9.4W	Hawthorne Ave.	SUBMERGED					
L 9.3W	Wellington Park	NO FLOW AT TIME OF INSPECTION					
L 9.1W	Kent St. drain	3.3	1,278	7	1,265	0.2	117,000
L 9.0WI	Union St. at Lynnwood Park	9.8	408	37	371	0.2	20,900
L 8.72W	Argyle St. N.W. of bridge	NO FLOW AT TIME OF INSPECTION					
L 8.71WI	Argyle St. S.W. of bridge	170	558	140	418	0.0	10,300,000
L 8.6W	Sydenham St.	SUBMERGED					

TABLE 4-2 - Cont'd

SAMPLE RESULTS - STORM AND WASTE WATER OUTLETS - TOWN OF SIMCOE

Sampling Point No.	Location	5-Day BOD ppm	Solids (ppm) Total	Susp.	Diss.	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
L 8.5W	Water St.	NO FLOW AT TIME OF INSPECTION					
L 8.41W	Victoria St. S.E. of bridge	28	400	2	398	2	
L 8.4W	Victoria St. N.W. of bridge	10	330	5	325	1.1	1,900
L 8.36I	Brook Woollen Mill - drying room outfall	NO FLOW AT TIME OF INSPECTION					
L 8.35I	Brook Woollen Mill - washing & drying plant outfall	55	2,364	64	2,300	4.6	160,000,000
L 8.3W	Patterson St.	2.4	448	11	437	0.3	234,000
L 8.11W	Woodhouse St.	NO SAMPLE					
L 8.0T	Effluent Simcoe WPCP	28*	492*	35*	460*	-	-

* Avg. sample results January 1962 to June 1963 inclusive

4.3 CONCLUSIONS

4.3.1 Water Supply

The existing ground-water supplies for the Town of Simcoe are capable of meeting present and foreseeable requirements.

Recently difficulties with water quality at the Cedar St. galleries have been encountered. As this is a major source of water for the town, every effort should be made to protect the supply. In order to ensure satisfactory quality, it may become necessary to provide disinfection facilities.

If the current test-drilling programme proves successful it may be desirable to use the new supply for regular service and maintain the Cedar St. works for reserve purposes.

4.3.2 Water Pollution

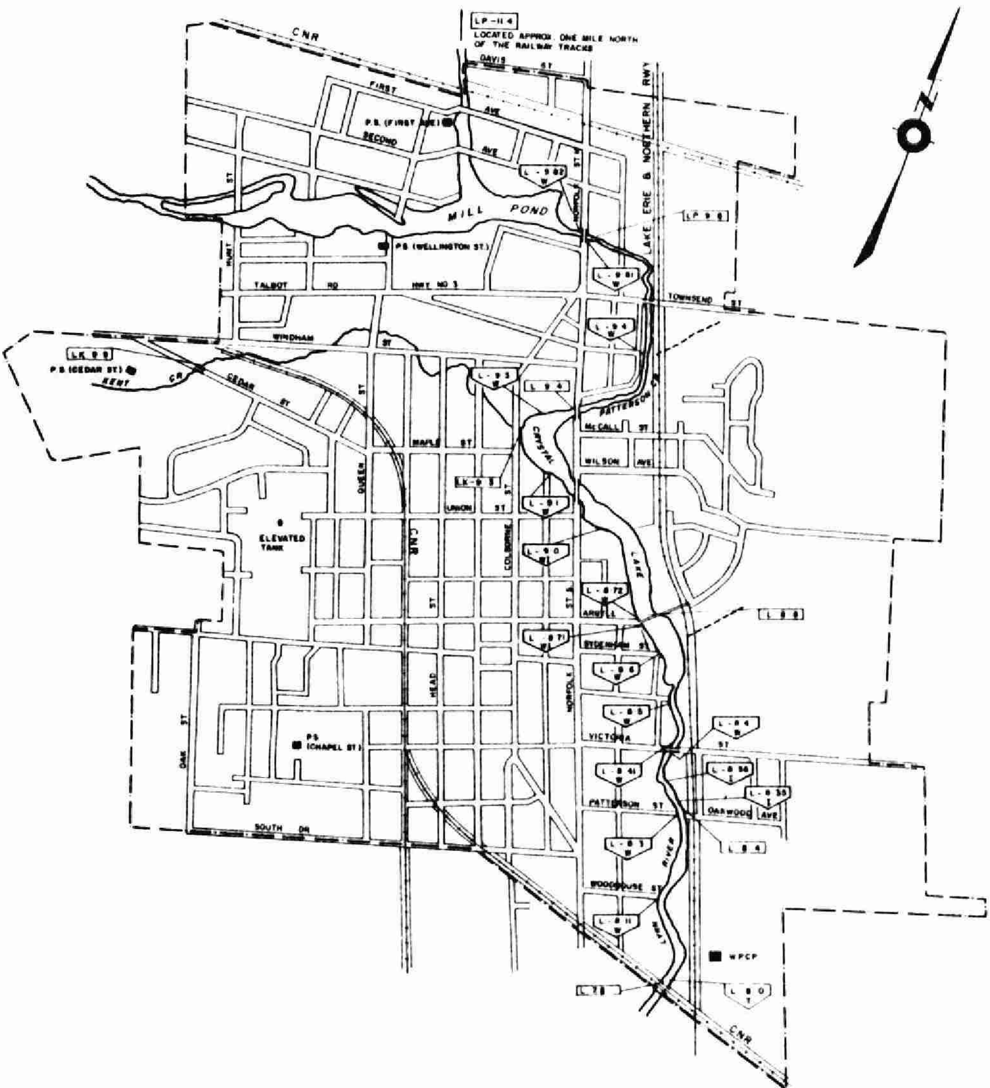
With completion of the extensions to the sewerage system including the water pollution control plant, the amount of untreated wastes being discharged to the Lynn River will be reduced.

Sufficient capacity is available at the new water pollution control plant for anticipated population increases.

Although the refuse disposal arrangements may not actively contribute to pollution, there is a definite possibility that water pollution may occur from time to time. This situation should be kept under surveillance.

The hydraulic load on the sewage works may be reduced by redirecting uncontaminated industrial cooling waters from sanitary sewers to storm or surface-water drains.

Sewage pollution is evident in several of the drainage systems discharging to the Lynn River. Every effort should be made to locate and disconnect any illegal connections.



LEGEND

- SAMPLING POINT SHOWING STREAM AND MILEAGE
- STREAM AND MILEAGE AT OUTFALL
- TYPE OF OUTFALL (SEWAGE TREATMENT PLANT)

(5) - OUTFALLS

------ - DITCH

P.S. PUMPING STATIONS

W.P.C.P. WATER POLLUTION CONTROL PLANT

FIGURE 4-1
TOWN OF SIMCOE
COUNTY OF NORFOLK

1000 500 0 1000 FT

CHAPTER 5

TOWN OF DELHI

CHAPTER 5

TOWN OF DELHI

5.1 WATER SUPPLY

5.1.1 Existing Facilities and Present Water Usage

Sources

The Delhi water supply is obtained from ground water and surface-water sources.

The ground-water supply (No. 1 Pumphouse) is spring fed. Water is collected and drawn into a covered concrete reservoir.

The supply from North Creek was developed in 1954 to augment the spring supply. Water is drawn into the Filtration Plant by means of a 14 inch cast iron intake pipe. The water depth above the intake varies, and during dry periods has been as shallow as 4 inches.

Water Quality

The bacteriological quality of the creek water is satisfactory. The average coliform counts per 100 millilitres of raw water samples did not exceed the recommended objectives for surface waters. Treated water quality has been satisfactory. Both supplies, while hard and high in alkalinity, are generally of good chemical quality. Typical analyses are quoted below:

Spring Supply

Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride as Cl	pH at Lab.
250	185	0.09	16	8.0

North Creek Supply

Raw Water

Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride as Cl	pH at Lab.	Colour in Hazen Units	Turbidity in Silica Units
241	176	0.24	14	8.2	6	2.8

Treated

Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride ad Cl	pH at Lab.	Colour in Hazen Units	Turbidity in Silica Units
258	189	0.12	13	8.2	5	0.7

Treatment

Chlorination is provided for the spring supply.

The Filtration Plant facilities include alum addition, mixing and settling, pressure filtration and chlorination.

Storage and Distribution System

Storage is provided by:

(1) An 80,000 gallon covered ground reservoir located at No. 1 Pumphouse.

(2) A 250,000 gallon open spring-fed pond located beside No. 1 Pumphouse.

(3) A 105,000 gallon elevated tank located at the end of Waverly St.

The distribution system consists of approximately 16.3 miles of cast iron mains varying in size from 4 inches to 8 inches in diameter. There are 117 hydrants throughout the system.

Water Usage

At the present time water is being supplied to 1,367 individual services in the town, of which 1,198 are domestic, 167 are commercial (12 metered) and two are industrial (metered).

The following table shows the water consumption figures for the town during the year 1962.

Month	No.1 Pumphouse (Gallons)	Filter Plant (Gallons)	Total (Gallons)	Avg.per Day (Gal./day)
Jan.	4,674,945	3,164,600	7,839,545	252,900
Feb.	4,207,500	2,896,200	7,103,700	253,700
March	4,674,945	3,180,800	7,855,745	253,400
April	3,877,500	4,013,900	7,891,400	263,000
May	4,647,500	10,096,900	14,744,400	475,600
June	1,182,500	7,069,200	10,827,700	361,000
	*2,576,000			
July	4,405,000	9,368,800	13,773,800	444,300
Aug.	4,751,000	8,173,300	12,924,300	416,900
Sept.	3,509,000	6,805,800	10,314,800	343,800
Oct.	4,215,000	5,283,100	9,498,100	306,400
Nov.	4,276,000	3,861,300	8,137,300	271,600
Dec.	3,869,000	4,492,400	8,361,400	269,700
	50,865,890	68,406,300	119,272,190	

* In mid June a flow meter was installed at the No. 1 Pumphouse. Prior to this time, water pumpage was calculated by measuring electrical energy consumed.

In 1962 the average daily consumption was 326,800 gallons per day (91 gpcpd) with a maximum consumption of 863,990 gallons per day. To date in 1963, the peak consumption has reached 841,600 gallons per day. While the combined pumping capacity is 1.22 mgd, during peak hourly consumption periods, demand frequently exceeds available capacity and water usage restrictions must be imposed. During dry periods, low flows in the North Creek seriously hamper water production at the Filtration Plant and further aggravate water shortages. In the summers of 1962 and 1963, it became necessary to obtain water for the Filtration Plant from Big Creek by means of temporary irrigation piping.

Water meters would discourage indiscriminate use and probably forestall the developing need for additional water supply facilities.

5.1.2 Potential Additional Supplies

Ground Water

A ground-water survey conducted by the Ontario Water Resources Commission and information obtained from past test drilling programmes indicate that areas favourable for the development of wells sufficient for municipal purposes exist near Delhi. These areas which occur to the south-east of town and other areas favourable for test drilling were outlined in a ground-water survey report prepared by the

Commission in 1960.

Surface Water

North Creek is the raw water source for the Filtration Plant. The production of this plant is severely hampered during the summer months by low flows in the creek.

The Big Creek Conservation Authority is planning to build a dam creating a 100 acre feet storage reservoir on North Creek a short distance upstream from the plant. Plans have been formulated to include an intake for the Filtration Plant in the dam.

5.1.3 Future Requirements

As predicted in Section 2.1.5 the 1980 population of the town will approximate 5,100 persons.

During 1962 the average per capita consumption was 91 gpd. If current trends for increasing water usage continue, the 1980 per capita consumption will rise to 100 gpd. For an expected population of 5,100 persons this will require an average daily supply of 510,000 gallons. Current peak daily demand ranges as high as 2.65 times the average demand. Projecting this trend to 1980, peak demands of 1,350,000 gallons per day can be expected.

Construction of the new conservation reservoir will provide an abundant source of water supply. However, increased supply facilities will be required. Ultimately, these needs could be met either by an expansion of the filtration plant, or further development of the groundwater resources at Delhi.

More immediately water needs may require improvements in capacities of the existing plants and/or the development of augmented secondary sources i.e. improved storage.

5.2 WATER POLLUTION

5.2.1 Water Pollution Control Projects

5.2.1.1 Municipal

General

Sewage from the section of town east of Big Creek is treated in a high-rate trickling filter plant. A separate system of storm

sewers is provided in this section. A built-up area extending into Middleton Township, and bordered by Talbot Road, Big Creek and North Creek, is serviced by individual subsurface disposal systems.

Sewage Pumping Stations

Two lift stations are associated with the sanitary sewerage system. These are located on Talbot Road and Crysler Street.

Water Pollution Control Plant

The plant designed to serve an equivalent population of 5,000 persons was constructed in 1947 and is located west of Western Avenue on the south side of Big Creek. Peak flows of 600,000 gpd can be accommodated. Sewage flows to the plant through a 15-inch diameter main. The treatment provided by this plant consists of screening or comminution, grit removal, primary sedimentation, high-rate biological filtration, and final sedimentation. Effluent is discharged to Big Creek.

Sludge digestion and drying facilities are available, however, at present, sludge stored at the plant is trucked to farm land.

Treatment Efficiency

The quality of the final effluent from the WPCP essentially has not met the Commission objectives for effluent quality. Average values for the BOD and suspended solids of the raw sewage and final effluent during the period from January 1962 to August 1963 inclusive, are summarized:

	BOD ppm				Suspended Solids ppm			
	Avg.	Max.	Min.	%Removal	Avg.	Max.	Min.	%Removal
Raw Sewage	193	275	115	-	206	349	139	-
Final Effl.	52	95	13	73.1	40	71	23	80.6

NOTE: %Removal based on average values

It is apparent that improved treatment is necessary. Piping alterations and improved process control are required.

Sewage Flow

The monthly and daily plant flows from February to October 1963 follow.

Period 1963	1000's of Gallons Total	Max. Day	Min. Day	Avg. Day
Feb.	4,496	297.0	132	160
March	5,812	252.8	145	188
April	3,901	171.7	112	130
May	4,567	178.4	126	147
June	4,828	193.8	131	161
July	5,182	213.9	132	167
August	5,155	237.8	156	166
September	4,228	175.9	117	141
October	4,100	160.0	106	132

Operating Difficulties

With the recent appointment of a permanent operator it is expected that operating procedures will be improved.

Operation would be facilitated by certain piping alterations to permit effluent recirculation to the primary section of the plant and by the provision of automatic controls for sludge pumpage.

5.2.1.2 Refuse Disposal

The refuse disposal site for the Town of Delhi is located near the eastern limits of the town, and north of the Canadian National right-of-way.

The dumping area is in a semi-swampy depression from which there is no apparent connection to any surface watercourse. The effects on ground water are unknown.

5.2.1.3 Industrial Wastes

There are only two industries in Delhi which use any appreciable quantity of water for industrial purposes.

Both of these are in the metal working field. One has wastes of no consequence while the other discharges intermittent quantities of highly alkaline wastes to a storm drain.

DELHI INDUSTRIES

Delhi Industries form, stamp, and work metal in the production of blowers and humidifiers. Parts are cleaned in a power washer with alkaline cleaners. The waste cleaners are alkaline and high in suspended solids and ether solubles. A typical analysis of spent cleaner follows:

5-Day BOD ppm	Susp. Solids ppm	Ether Solubles ppm	Alkalinity as $CaCO_3$ ppm
72	267	380	504

The company has been advised to dispose of these wastes in a sanitary landfill site.

Approximately 3,000 gpd are used for rinses. The effluent is discharged to a drainage ditch. Sanitary wastes are directed to the municipal sewers.

DELHI METAL PRODUCTS LIMITED

This company does forming and welding of TV antenna towers. An average of 12,700 gpd water is supplied by the PUC for cooling purposes. This water leaves the plant at an elevated temperature, but is otherwise uncontaminated. It discharges to a storm drain.

5.2.2 Surface Water Quality and Major Sources of Pollution

The analyses of creek and storm sewer samples are listed in Tables 5-1 and 5-2.

The stream results show some degradation as Big Creek flows through the town. This can be attributed to untreated wastes entering the stream from municipal storm drains, (Note sample nos. B 30.62W and B 30.2W). Illegal connections to these drains should be located and disconnected.

5.2.3 Future Requirements

Providing the sewage treatment plant can be efficiently operated, there appears to be sufficient capacity available for the anticipated requirements of the town.

Careful supervision of existing and future septic tank

TABLE 5-1

SAMPLE RESULTS - BIG CREEK - DELHI SECTION

Sampling Point No.	Location	5-Day BOD	Turbidity in Silica Units	Anionic Detergents as A B S	M.F. Coliforms per 100 ml	Dissolved Oxygen	Temperature
B 31.8	One (1) mile north of Delhi	1.3	0.5	0.0	80	8.6	13.0°C.
B 30.7	Hwy. #3 bridge	1.1	0.7	0.0	70	---	---
B 30.6	at Delhi	0.9	1.1	0.0	21,000	---	---
B 30.0	below Delhi	1.7	1.3	0.1	15,900	8.3	13.5°C.

TABLE 5-2

SAMPLE RESULTS - STORM AND WASTE WATER OUTLETS - TOWN OF DELHI

Sampling Point No.	Location	5-Day BOD	Solids Total	Solids Susp.	Solids Diss.	Anionic Detergents as A B S	M.F.Coliform Count per 100 ml
B 31.4W	James St. N.	NO FLOW AT TIME OF INSPECTION					
B 30.69(a)W	Talbot Rd. S.E. corner bridge	SUBMERGED					
B 30.69(b)W	Talbot Rd. S.W.corner bridge	2.2	3,364	1.4*		0.1	114
B 30.64W	Mill St.	NO FLOW AT TIME OF INSPECTION					
B 30.62W	Eagle St.	106	610	152	458	0.0	2,120,000
B 30.6(a)W	Western Ave. S.E. corner bridge	1.6	1,272	1.8*		0.1	600
B 30.6(b)W	Western Ave. S.W. corner bridge	2.2	1,576	1.0*		0.0	42
B 30.2W	Imperial St. rear of Imperial Tobacco	165	864	273	571	0.0	1,970,000

* Turbidity expressed in Silica Units

installations in Middleton Township in the vicinity of the proposed conservation reservoir will be required to prevent pollution from faulty or malfunctioning systems. Probably the best long-term pollution control measure would be the provision of sewers in this area.

5.3 CONCLUSIONS

5.3.1 Water Supply

The Town of Delhi encounters water shortage problems during dry summer periods. This situation is aggravated by limited pumping capacity and frequently water use restrictions are required. Improvements will be required in supply facilities to meet emergency and peak water demands. The early provision of conservation storage will improve the situation.

5.3.2 Water Pollution

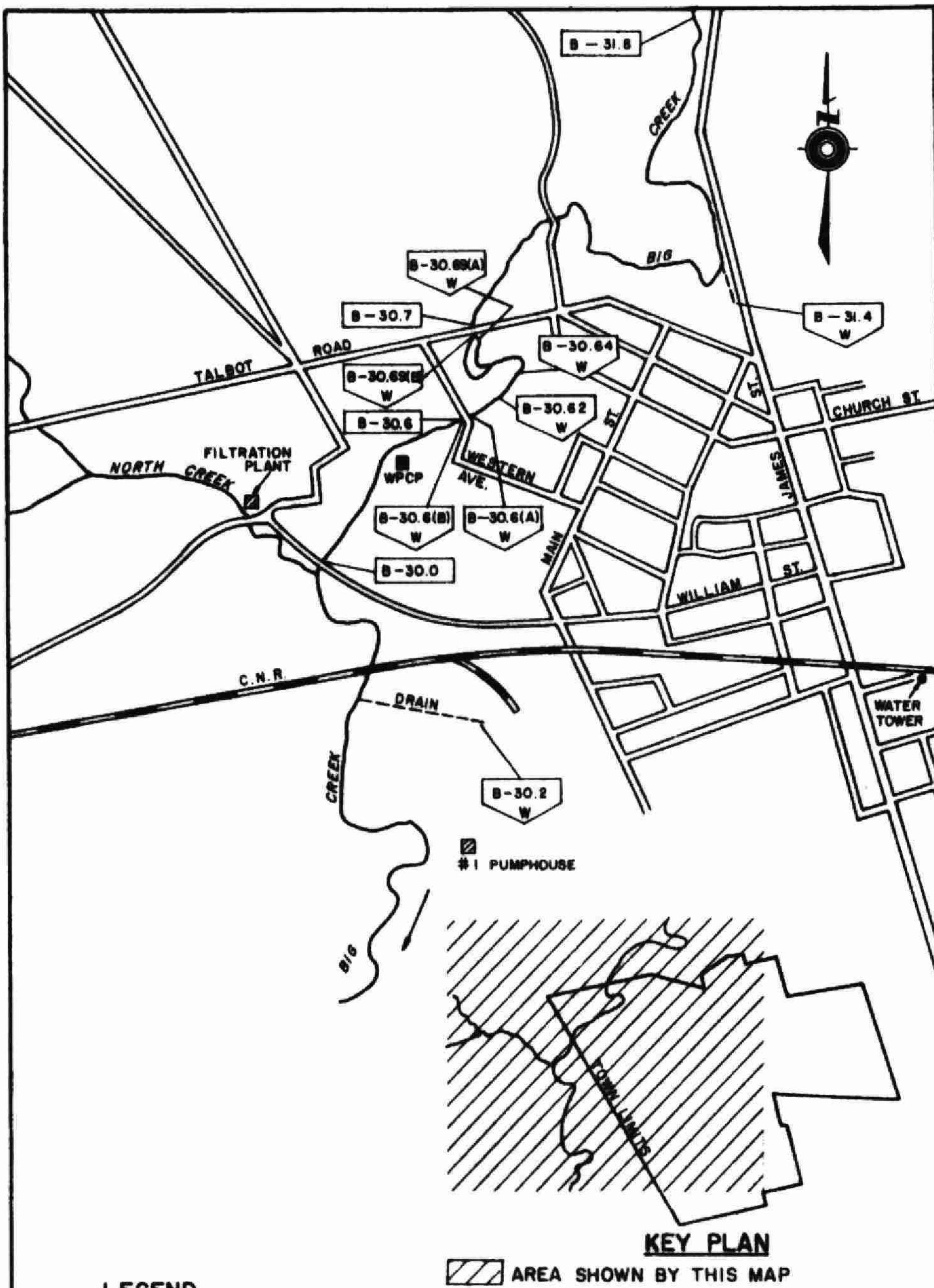
The sewage treatment plant appears to have sufficient capacity available for the anticipated requirements of the town.

In the past, operating difficulties were encountered due to the limited attention the plant received. With the recent appointment of a permanent operator it is expected that operating procedures will improve.

Plant operation would be facilitated by the provision of certain piping alterations for effluent recirculation. Similarly automatic controls for sludge pumpage would be desirable.

Careful supervision of existing and future septic tank installations in Middleton Township in the vicinity of the proposed conservation reservoir will be required to prevent pollution from faulty or malfunctioning systems. It is likely that the best long-term solution would be the provision of sewers in this area.

Drainage outfalls within the Town of Delhi carry heavy contamination. The drains listed in this report should be thoroughly checked to determine the sources of pollution, and remedial action taken.



LEGEND

B – 31.8	SAMPLING POINT SHOWING STREAM AND MILEAGE
B – 31.4 W	STREAM AND MILEAGE AT OUTFALL TYPE OF OUTFALL I – INDUSTRIAL W – STORM SEWER
■	WATER POLLUTION CONTROL PLANT
▨	WATERWORKS

FIGURE 5-1

TOWN OF DELHI

COUNTY OF NORFOLK

SCALE : 1" = 1300'

CHAPTER 6

TOWN OF PORT DOVER

CHAPTER 6

TOWN OF PORT DOVER

6.1 WATER SUPPLY

6.1.1 Existing Facilities and Present Water Usage

Sources

The town water supply was originally derived from a series of springs. The water was collected in a 25,000 gallon ground reservoir before its distribution to consumers.

This source was replaced in 1955 by a 1 mgd capacity water treatment plant situated on Lake Erie west of town. Raw water enters the plant, through a 20-inch diameter gravity intake pipe which extends 1,500 feet into the lake to a depth of 13 feet.

The springs are only used during periods of peak demand to supplement the lake supply.

Water Quality

The bacteriological quality of the raw water is generally satisfactory. Of the samples submitted to the OWRC Laboratory during the past two years, only one exceeded the objective of 2,400 per 100 millilitres. Raw water quality may be considered as normal for a supply from Lake Erie. Typical analyses of 1962 and 1963 samples follow:

	Raw Water			Treated Water		
	Avg.	Min.	Max.	Avg.	Min.	Max.
Hardness as $CaCO_3$	128	114	136	132	124	148
Alkalinity as $CaCO_3$	98	80	104	95	68	106
Iron as Fe	0.60	0.00	2.00	0.32	0.00	1.30
Chlorides as Cl	23	18	31	24	21	33
pH at Lab.	7.9	7.6	8.2	7.8	7.2	8.1
Colour in Hazen Units	7.6	< 5	20	< 5	< 5	< 5
Turbidity in Silica Units	10.2	2.6	37	7	0.6	31.0

The high concentrations of iron indicated in the summary are apparently due to suspended material present during periods of high turbidity rather than dissolved iron.

Treatment

Treatment consists of alum coagulation and settling in a solids contact unit, filtration and chlorination. The use of alum is dictated by raw water turbidity.

Storage and Distribution

The following storage facilities are available:

(1) A 50,000 gallon treated water reservoir located at the treatment plant.

(2) A 150,000 gallon elevated storage tank situated at the northern limits of the built-up area.

(3) A 25,000 gallon ground-level storage reservoir at the standby spring supply.

The distribution system consists of approximately 14 miles of cast iron and asbestos cement mains ranging in diameter from 4 to 12 inches. There are 105 fire hydrants located in the system.

Water Usage

At the present time, 1,600 services including 33 commercial and 19 industrial are supplied. All industrial and a portion of the commercial services are metered. The domestic services are on a flat rate schedule.

The 1962 and part of 1963 consumptions are tabulated:

	1000's of Gallons	
1962	Total Consumption	Average Day
January	18,283	588
February	16,459	587
March	17,128	552
April	17,092	567
May	18,558	598
June	19,606	654
July*	24,470	791
August	23,699	765
September	23,218	775
October	23,254	752
November	22,548	752
December	19,989	654

TOTAL 1962	244,304

* 448,000 gallons were supplied from the old plant during peak periods.

1963	1000's of Gallons Total Consumption	Average Day
January	20,219	652
February	18,994	676
March	20,705	668
April	19,170	638
May	19,768	637
June	20,639	690
July	25,434	822
August	23,748	766
September	22,374	745
October	23,935	762

The maximum daily pumpage of 1,098,500 gallons occurred on July 5, 1963 and reflects the influence of weekend populations. As the filtration plant has a design capacity of 1 mgd, the ground-water source was required.

6.1.2 Potential Additional Supplies

Ground Water

A test drilling programme undertaken by the Port Dover Public Utilities Commission in 1948 consisted of nine test holes in Lot 6, Concession 2, Township of Woodhouse. A supply of water was located in a sand and fine gravel aquifer at a depth of about 70 feet and was test pumped at rates up to 27 gpm with 1 foot of drawdown. The results indicate that the aquifers associated with sand and gravel deposits in the Lynn River valley might support municipal wells. A ground-water survey would be required to trace the extent and location of the aquifers.

Surface Water

Lake Erie provides an unlimited resource for Port Dover.

6.1.3 Future Requirements

From section 2.1.2, it is anticipated that the population of Port Dover may become 4,400 persons by the year 1980.

During 1962, a total of 244,304,000 gallons of water were pumped, representing an average daily consumption of 669,300 gallons and a per capita consumption of 214 gpd. This unusually high consumption may be attributed to the W. F. Kolbe Company which utilizes an average of 315,000 gpd for processing purposes. Excluding the Kolbe Company demand, the daily consumption would be 355,000 gpd or 116 gpcpd. Allowing for increasing use of water, a consumption of 125 gpcpd can be expected by 1980. For the 1980 projected population this would result in a total domestic requirement of 550,000 gpd.

It is probable that additional capacity will be required to satisfy the peak demands.

6.2 WATER POLLUTION

6.2.1 Water Pollution Projects

6.2.1.1 Municipal

General

To this date, sanitary and industrial wastes have been discharged to the Lynn River without treatment.

During 1963 the construction of a water pollution control plant and the extension of the existing sewer system was undertaken. The new facilities will provide treatment for the major portion of the town's domestic wastes as well as wastes from the two major food processing industries.

Treatment Plant Data

The new facilities are designed to provide primary treatment for a flow of 2.088 mgd, with reductions of 30 and 60 per cent of the BOD and suspended solids content respectively. The effluent will be discharged to Lake Erie some 2,700 feet from shore. This arrangement will facilitate dilution of the effluent.

6.2.1.2 Refuse Disposal

The disposal site for refuse collected in the town is located approximately 1½ miles west of town on Lot 5, Concession 1, Township of Woodhouse.

Refuse is dumped into a gully and covered by the trench method of landfill. Drainage appears to be to an unnamed watercourse which flows into Lake Erie. Runoff or seepage has not been evident. However, because of the proximity to the watercourse, it is possible that pollution of the stream might occur during wet periods.

6.2.1.3 Industrial Wastes

In Port Dover there are two large industries which use sizeable quantities of water. As they are both in the food processing category, the wastes are quite strong.

Other enterprises in the town are more of a commercial nature and their discharges differ little from sanitary sewage.

Information on the two large industries is given below:

W. F. KOLBE AND COMPANY LIMITED

Fresh and frozen chickens, turkeys and fish are processed by this company. An average of 315,000 gpd of water is supplied by the PUC for use in icemaking, process and for steam. In addition the company draws an average of 650,000 gpd from the Lynn River for cooling purposes. It is returned to the river essentially unchanged. All liquid wastes, including blood, are discharged to the Lynn River. These wastes contain feathers and are high in BOD, suspended solids, fat and nitrogenous material. Solid wastes are rendered in the plant. The connection of this industry to the municipal system is expected early in 1964.

CULVERHOUSE CANNING COMPANY LIMITED

This company cans fruits and vegetables. The PUC supplies an average of 16,600 gpd of water for process purposes. Wastes from processing are screened and discharged to the Lynn River with a high BOD and suspended solids content. In addition, the company pumps an average of 36,000 gpd from the river for boiler make-up and cooling. This latter water is discharged to the Lynn River at an elevated temperature, but otherwise uncontaminated. It is also expected this plant will be taken into the municipal system in 1964.

FISHING OPERATIONS

Several small volume fishing operations are carried out

TABLE 6-1

SAMPLE RESULTS - LYNN RIVER - PORT DOVER SECTION

Sampling Station No.	Location	5-Day BOD (ppm)	Total Solids (ppm)	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M. F. Coliform Count per 100 ml
L 2.2	Upstream from Silver Lake	1.1	360	1.7	0.3	730
L 1.2	at dam downstream from Silver Lake	4.6	346	6.0	0.4	640
L 1.0	downstream from Kolbe Co. Plant	54.0	524	-	0.3	890,000
LB 2.2	Black Creek at Conc.#2 Woodhouse Twp.	2.1	370	14.0	0.0	180
LB 0.9	Black Creek prior to junction with Lynn River	2.7	354	17.0	0.1	25,000
L 0.6	downstream from Brant St. outfall	6.6	370	8.5	0.2	148,000
L 0.4	at Hwy.#6 (bridge)	22.0	396	12.5	0.6	171,000
L 0.1	at Harbour Mouth	6.0	356	9.0	0.2	132,000

TABLE 6-2

SAMPLE RESULTS - MUNICIPAL AND INDUSTRIAL WASTE EFFLUENTS - PORT DOVER

Sampling Point No.	Date of Sample	Location	5-Day BOD (ppm)	Solids Total (ppm)	Solids Susp. (ppm)	Solids Diss. (ppm)	M.F. Coliform Count per 100 ml
L 0.85I	4/22/63	Kolbe Fishery	175	510	151	359	125,000
	9/9/63	Kolbe Fishery	20	314	23	291	24,300,000
L 0.84I*	4/22/63	Kolbe Effluent	260	534	183	351	15,900,000
	9/9/63	Kolbe-Culverhouse Effluent	1,020	1,930	644	1,286	1,870,000
L 0.4W	9/9/63	Patrick Street Sewer	98	454	3	451	13,900,000
L 0.39I	4/22/63	Misner Fishery	2,850	3,902	1,378	2,524	270,000
L 0.12I	4/22/63	East Erie Fishermen's Co-op.	1,280	2,546	1,456	1,090	37,000
L 0.11I	4/22/63	Dover Fishermen's Co-op.	32	320	69	251	110,000
L 0.1I	4/22/63	Fur Breeder Association	250	462	146	316	370,000

* Combined outlet from Kolbe Processing and Culverhouse Canning Co.

in the harbour area. These consist of catching and cleaning of fish. Fish parts that are not intended for human consumption are frozen for utilization as pet foods. Washings and scales are discharged to the harbour. Typical analyses of waste effluents from these companies are listed in Table 6-2. It is anticipated that these wastes will be included in the municipal sewerage system.

6.2.2 Surface Water Quality and Major Sources of Pollution

Reference should be made to Table 6-1 for water quality data on the Lynn River and Black Creek. Progressive deterioration of the river as it passes through the town is very evident. Sample analysis of the responsible sources of pollution is provided in Table 6-2. Gross pollution is indicated.

6.2.3 Future Requirements

The anticipated water pollution control requirements of Port Dover will be met with the completion of the sewage works programme.

6.3 CONCLUSIONS

6.3.1 Water Supply

During peak demand periods, especially the summer holiday weekends, the capacity of the Filtration Plant is taxed and the reserve ground-water source is required to supplement the lake supply. As the town expands this problem will become more acute and expansion of the filtration plant may be necessary.

Lake Erie offers the most readily-available source of supply.

6.3.2 Water Pollution

The construction of the new water pollution control plant will eliminate the major sources of pollution. It is expected that the plant will provide sufficient capacity to meet the needs of the town for a number of years.

The effort should be directed to provide complete service in the built-up areas and thus eliminate all discharges of untreated waste water.

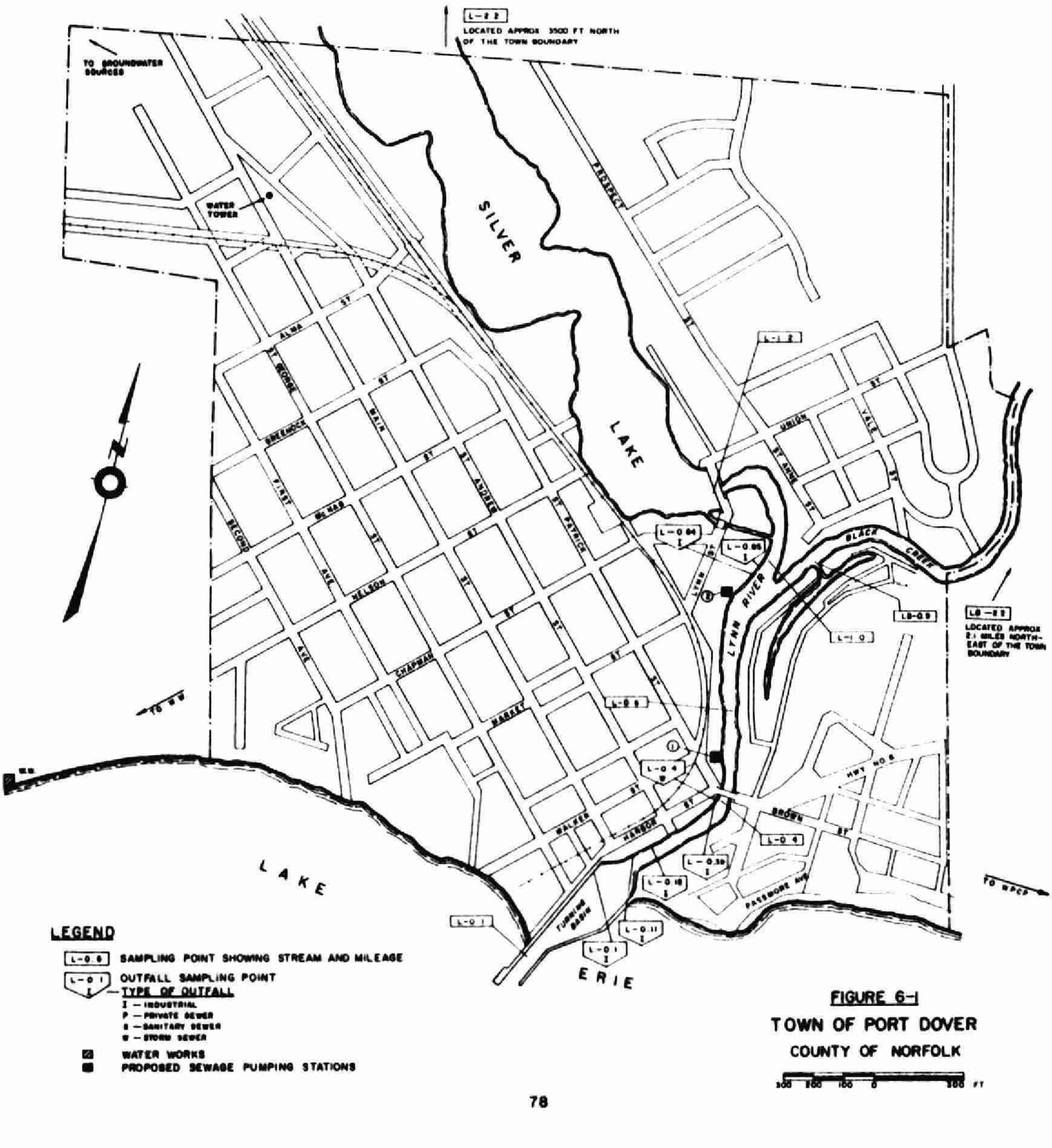


FIGURE 6-1

TOWN OF PORT DOVER

COUNTY OF NORFOLK

CHAPTER 7

TOWN OF WATERFORD

CHAPTER 7

7.1 WATER SUPPLY

7.1.1 Existing Facilities and Present Water Usage

Sources

At the present time, the Town of Waterford water supply is obtained from two ground-water sources known as:

(a) The Main Supply
(b) The Auxiliary Supply

Main Supply

The main supply consists of wells and a pumping station located on a 16-acre site on Mechanic St. in the north-east section of the town. This source was developed in 1924 and consists of 15 dug wells ranging in depth from 10 to 30 feet. All surface runoff is directed away from the site. Water from the wells feeds by gravity to the reservoir at the pumping station.

In 1950 an additional well was drilled to a depth of 80 feet in the same area. Water is raised by air lift and directed to the reservoir at the pumphouse.

Auxiliary Supply

The auxiliary supply is 159 ft. deep drilled well located on Nichol St. near the centre of town. Also drilled in 1950 the well was put into service in 1958. As the water from this source contains hydrogen sulphide, the well is used only during periods of high water demand.

Water Quality

The bacteriological quality of the treated water is satisfactory. The water from both the main and auxiliary supplies is hard with a high alkalinity. Both drilled

wells contain hydrogen sulphide; the content of the auxiliary well is greater than that at the main plant. The 15 shallow wells do not contain hydrogen sulphide. Typical water analyses are:

Source	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride as Cl	pH at Lab.	Fluoride as F
Main Supply	300	206	0.13	28	7.75	0.3
Aux. Supply	437	183	0.18	20	7.75	-
Test Wells	210	206	0.12	13	7.9	-

Treatment

Chlorination is practised at both pumping stations. A limited amount of aeration for hydrogen sulphide removal is provided at the main pumphouse by permitting the water to discharge from a horizontal pipe and splash on the surface of the reservoir.

To provide aeration for hydrogen sulphide removal at the auxiliary pumping station, the incoming water is directed vertically upward through an orifice and splashed off a horizontal plate onto the surface of the reservoir.

Storage and Distribution System

Storage on the distribution system is provided by:

(1) A 165,000 gallon covered ground storage reservoir at the main plant on Municipal St.

(2) A 25,000 gallon covered ground storage reservoir at the auxiliary well on Nichol St.

(3) A 75,000 gallon elevated storage tank located on high ground near the main plant.

The distribution system consists of approximately 2,000 feet of 8-inch, 4 miles of 6-inch and 2¼ miles of 4-inch diameter mains.

Operating Difficulties

Certain problems have been experienced with meeting peak demands. This has necessitated water restrictions in the summer.

Problems in maintaining a chlorine residual in the water from the auxiliary well are encountered during periods of high demand as there is insufficient aeration and storage at the auxiliary well to provide satisfactory hydrogen sulphide removal. The chlorine demand is very high, requiring great amounts of sodium hypochlorite.

Water Usage

Water is supplied to 550 individual services in the town, of which 525 are domestic and 25 are commercial.

As the system is not metered, accurate consumption figures are unavailable. However, it has been estimated that the water consumption for the year 1962 was 73,210,000 gallons. This corresponds to an average daily flow of 200,000 gallons, and a per capita usage of 87 gpd. To date, the maximum pumpage has been approximately 300,000 gallons per day.

7.1.2 Potential Additional Supplies

Ground Water

Waterford is located in an area where bedrock aquifers yield large quantities of water sufficient for municipal purposes. However, the quality of the water is unsatisfactory because of a high hydrogen sulphide content. Attempts at treatment for removal of the mineral have met with only limited success.

Geological data indicate that overburden aquifers containing a more satisfactory quality water occur near the town. Water-filled gravel pits extending over an area of 40 acres are located about 1.5 miles west of Waterford. Well logs indicate that the gravels extend to depth and are saturated. Hydrologically these conditions are excellent for the development of high capacity wells, as the pits would serve as good sources of recharge for the wells. The results of recent test drilling by the town indicated that at least 1 mgd should be available from this area.

Surface Water

Nanticoke Creek might be considered as a future source of water, however, the cost of treatment required would probably not be competetive with the development of ground-water sources. As ground-water sources appear plentiful in this area, it is not likely that the use of the creek will be required in the foreseeable future.

7.1.3 Future Requirements

By 1980 it is estimated that the population of the Town of Waterford will approach 3,300 persons. Using a per capita consumption of 100 gpd for 1980, it is estimated that an average daily demand of 330,000 gallons could be anticipated.

Additional sources of water are required to satisfy present and future demands. Correspondingly, storage facilities also require enlarging. By 1980, probably 400,000 to 500,000 gallons of storage will be required.

7.2 WATER POLLUTION

7.2.1 Water Pollution Control Projects

7.2.1.1 Municipal

General

Approximately 50% of the built-up area is provided with sewage service. Treatment is provided by a waste stabilization lagoon. The construction of the collection system and lagoon was completed in August 1963. These facilities are designed to permit their extension to serve the remaining incorporated area.

Sewage Pumping Stations

The lift stations are located on Mechanic St. East and Main St. South at the high school. The former employs an overflow arrangement to Nanticoke Creek. The latter station will become redundant when the sewerage system is extended to the south end.

Water Pollution Control Unit

The waste stabilization lagoon is located east of the

town, on the south-west side of Nanticoke Creek. It has a total surface area of 15 acres and is designed to accept domestic waste from a population of 1,000 persons, together with industrial waste from the Canadian Canners Limited pickling operations and Pennmans Limited. The average daily sewage flow expected is 130,000 gallons per day. Raw sewage is being pumped to the lagoon through a 10-inch diameter force main located on Mechanic St. East. When the water reaches operating level the effluent will be discharged to the Nanticoke Creek.

7.2.1.2 Refuse Disposal

The refuse disposal facilities for the Town of Waterford are situated in the Township of Townsend and will be discussed in the township section. This presents a major pollution problem.

7.2.1.3 Industrial Wastes

There are two relatively large industrial water users in Waterford. One has little waste other than boiler blowdown. The other produces fairly strong wastes, the quantities of which are subject to seasonal variation.

PENNMANS LIMITED

The plant produces only yarns of wool, nylon and orlon. The PUC supplies an average of 2,800 gpd of water for boiler and sanitary use. The company uses a septic tank, and boiler blowdown is discharged to a storm ditch.

CANADIAN CANNERS LIMITED

Pickles and olives are packed in this plant and an average of 34,500 gpd is used for process water and steam. The wastes contain some sodium chloride from the brine used in pickling and also have a high BOD. Coarse solids are screened and transported to a dump. The screened waste is discharged to a ditch. Other liquid wastes discharge to a septic tank. Liquid wastes will be discharged to the municipal sewers with the completion of the new system.

7.2.2 Surface Water Quality and Major Sources of Pollution

Nanticoke Creek provides drainage for the town. When sampled the water quality showed deterioration due to the discharge of waste waters. The sample results are

TABLE 7-1

SAMPLE RESULTS - NANTICOKE CREEK - WATERFORD SECTION

Sampling Point No.	Location	5-Day BOD (ppm)	Total Solids (ppm)	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml	Dissolved Oxygen (ppm)	Temp.
N 25.8	Waterford pond above Waterford	3.0	314	2.1	Trace	90	-	-
N 24.8	Waterford pond	12	536	8.0	0	16,000	8.5	15°C.
N 24.7	Waterford pond	6.7	476	9.0	Trace	2,800	-	-
N 24.6	above dam, west of Hwy.#24	8.9	504	6.0	0.1	6,900	12.0	15.5°C.
N 24.4	below Waterford dam	3.2	466	8.0	0.1	51,000	7.8	12°C.

TABLE 7-2

SAMPLE RESULTS - STORM AND WASTE WATER OUTLETS - TOWN OF WATERFORD

Sewer Outfall	Location	5-Day BOD (ppm)	Solids (ppm) Total	Solids (ppm) Susp.	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
N 25.0I	Canadian Canners Ltd.	NO	SAMPLE	RESULTS	ARE AVAILABLE	81,000,000
N 24.8 (b)W	John St.	NO	FLOW AT	TIME	OF INSPECTION	
N 24.8 (a)W	opposite Penmans Plant	35	938	41	3	150,000
N 24.65W	rear hotel	220	1,466	264	38	147,000,000
N 24.6W	rear Bank of Montreal	140	816	82	6	9,200,000

summarized in Tables 7-1 and 7-2.

7.2.3 Future Requirements

At the present time the new water pollution control facilities serve approximately 50 per cent of the built-up area. While these measures will eliminate the major sources of pollution, it is desirable that the wastes from all built-up areas within the town be treated.

7.3 CONCLUSIONS

7.3.1 Water Supply

The existing sources are not sufficient to satisfy peak demands. This has necessitated water restrictions during the summer months.

The waters from the auxiliary well and the drilled well at Pumphouse No. 1 contain hydrogen sulphide which impairs the overall quality of the water delivered to the consumer.

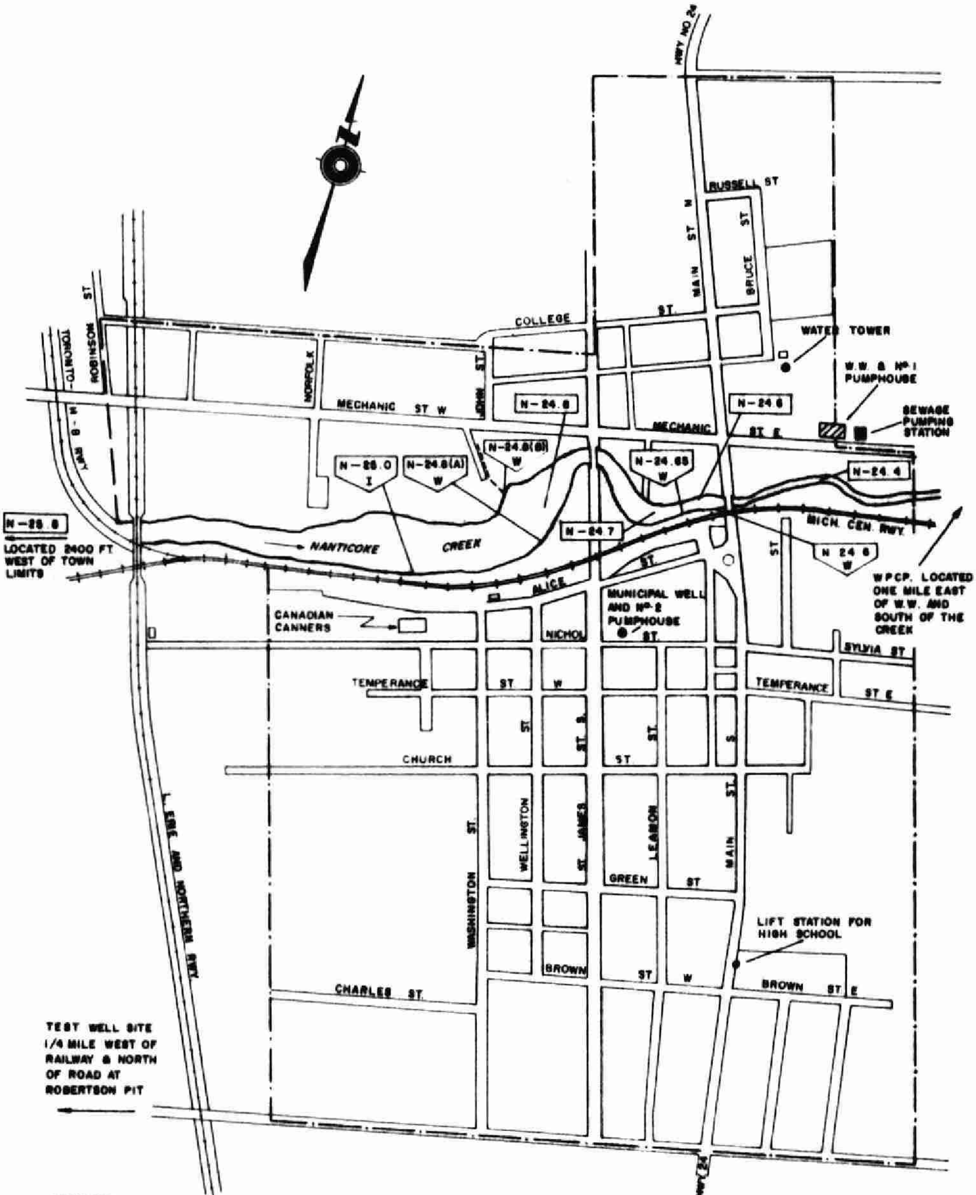
The ground-water exploration programme would indicate that a 1 mgd source of preferred quality water could be developed in the test area.

This source should be developed with the view of replacing the existing supplies which contain objectionable hydrogen sulphide.

7.3.2 Water Pollution

The construction of sewage works for a part of the Town of Waterford has recently been completed. The major sources of pollution of Nanticoke Creek will be eliminated. To continue the pollution abatement programme, efforts should be directed toward elimination of all untreated waste water discharges to the watercourse by extending the sewer system as required.

Runoff from the municipal refuse disposal site located in the Township of Townsend (Chapter 12) is a major source of pollution of Nanticoke Creek. The present site should be abandoned and a more suitable location selected.



LEGEND

N. 24.6 - SAMPLING POINT SHOWING STREAM AND MILEAGE

N 24.7 W - STREAM AND MILEAGE AT OUTFALL - TYPE OF OUTFALL

W - STORM SEWER

P - PRIVATE SEWER

—— - EXISTING SEWER

- - - - - OPEN DITCH

FIGURE 7-1

TOWN OF WATERFORD

COUNTY OF NORFOLK

800 400 0 800 FT.

CHAPTER 8

VILLAGE OF PORT ROWAN

CHAPTER 8

VILLAGE OF PORT ROWAN

8.1 WATER SUPPLY

8.1.1 Existing Facilities and Present Water Usage

Source

The Village of Port Rowan obtains its water from Lake Erie. The plant intake extends approximately 500 feet into a shallow area known as Inner Bay. The low lift pumping station lifts raw water to the treatment plant on high ground.

Water Quality

The bacteriological quality of the treated water has been satisfactory.

Chemical analyses of treated water samples collected during the period from May 1962 to September 1963 are listed below:

	Raw Water			Treated Water		
	Avg.	Min.	Max.	Avg.	Min.	Max.
Hardness as $CaCO_3$	160	104	272	169	104	312
Alkalinity as $CaCO_3$	132	68	236	121	62	242
Iron as Fe	1.23	0.3	3.40	0.31	0.05	0.92
Chlorides as Cl	16	9	22	20	11	30
pH at Lab.	8.0	7.4	9.1	7.7	7.5	8.7
Manganese as Mn.	0.6	*	*	0.7	*	*
Colour in Hazen Units	25	15	40	7	5	10
Turbidity in Silica Units	23.8	1.8	59.0	3.4	0.8	18.0

* Maximum and minimum values are not available.

Iron and Manganese

During the winter, the surface of Inner Bay freezes over. As the bay is quite shallow, anaerobic conditions usually occur under the ice. These conditions induce the release of carbon dioxide gas which causes iron and manganese present in the silt deposits to go into solution. Excessive iron and manganese concentrations have been found in the water drawn into the intake at this time of year.

Colour

Inner Bay water is also subject to colour problems related to the abundant aquatic growths which flourish in the shallow bay.

Turbidity

The raw water turbidity in the Port Rowan area varies considerably during the year and over short periods of time. During calm conditions, and when winds blow from the west and south, the average turbidities range between 1 and 5 ppm. In the event of east winds, the raw water turbidity may exceed 50 ppm.

Treatment

The water treatment plant was built in 1949. Treatment provided consists of batch coagulation with alum, settling, chlorination and pressure filtration.

Proposed Improvements

Under construction, treatment plant improvements will include the provision of a continuous flow solids contact unit for pretreatment, and an additional pressure filter. The pumping capacity will be increased by enlarging the impellers on the high lift pumps and installing new low lift pumps. The alterations will provide a production capacity of 0.3 mgd.

Storage and Distribution System

Storage is provided by a 186,000 gallon standpipe located adjacent to the water treatment plant.

The distribution system consists of 3 miles of cast iron mains varying in size from 4 to 6 inches in diameter. There are 25 hydrants throughout the system.

Water Usage

Water is being supplied to 273 individual services of which 230 are residential and 43 are commercial and one industrial.

The following table shows the approximate consumption during the period March to October 1963. This data was

obtained by noting the number of batches of water treated each day.

	GALLONS Total Consumption	Average Day
March (12-31)	806,177	42,500
April	1,343,629	44,700
May	1,558,553	50,300
June	1,807,420	58,200
July	2,830,579	91,400
August	2,882,695	93,200
September	2,938,060	94,600
October	2,436,440	78,400

The maximum daily pumpage recorded in 1963 was 125,000 gallons. The apparent increase of consumption in the summer and fall months probably reflects the demand created by the Innes Foods Co. Ltd. tomato processing plant which established in Port Rowan during the year.

Operating Difficulties of Existing System

In the past, operating difficulties resulted from the fill and draw nature of the process. Poor floc formation and settling frequently occurred and repeated backwashing became necessary. It is expected that these problems will be eliminated with the provision of the new works.

In addition, as well as providing extra capacity, the plant improvements will facilitate the treatment of the water in the spring time when taste and odour problems occur.

8.1.2 Potential Additional Supplies

Ground Water

Port Rowan is located in an area where there appears to be a lack of water-bearing deposits in the overburden. This is substantiated by earlier test drillings. Records for other wells in the vicinity indicate that generally unfavourable ground-water conditions exist for some distance around the town. Deep drilled wells obtain water from bedrock aquifers but the water usually contains hydrogen sulphide. A ground-water survey might be carried out before ground water is dismissed as a source of supply.

Surface Water

Lake Erie offers an abundant raw water source. However, due to the shallow bay and associated aquatic vegetation, water quality problems arise. Treatment is made difficult. Preferred quality water can be obtained beyond Long Point. However, this would necessitate lengthy and expensive extension of the intake.

8.1.3 Future Requirements

The predicted population of Port Rowan, based on current provincial growth trends (Section 2.1.5) may approximate 1150 persons by 1980. The new plant capacity should be adequate to meet the anticipated domestic needs for the community and provide a reasonable allowance for industrial expansion.

8.2 WATER POLLUTION

8.2.1 Water Pollution Control Projects

8.2.1.1 Municipal

Private sewage disposal systems are employed in Port Rowan. Since the establishment of the Norfolk County Health Unit in 1957, all private sewage disposal systems have been installed under the supervision of the health unit. However, unfavourable soil conditions in the area cause difficulties in operation of these systems and consequently some illegal connections have been made to storm drains.

8.2.1.2 Refuse Disposal

The refuse collected in Port Rowan is disposed of at the Township of Walsingham refuse disposal site, located on Lot 16, Concession 1. The trench and fill method of disposal is used. To date, no pollution resulting from run-off or seepage from the site has been recorded.

8.2.1.3 Industrial Wastes

The processing wastes from the Innes Foods Co. Ltd. tomato canning factory are discharged into a retention pond. This waste is to be retained in the pond throughout the winter months and discharged to the watercourse during periods of heavy spring runoff. The receiving stream enters Inner Bay about one-half mile south-west of the municipal water works intake. This constitutes a potential hazard to the

municipal supply. Consequently, care should be exercised in the withdrawal of wastes from the pond.

8.2.2 Surface Water Quality and Major Sources of Pollution

There are five storm water drains in the village which discharge into Inner Bay. The location of the drains and associated conditions encountered are noted below (See Fig.8-1).

Sampling Point No. LEI 218.8W - The drain is located below the Innes Foods Co. Ltd. plant. No flow was noted at the time of the investigation but there was some evidence of sanitary wastes accompanied by characteristic sewage odours.

LEC 218.4W - The drain is situated west of College Ave. There was insufficient flow to obtain a sample. However, there was evidence of sanitary sewage in the drain.

LEM 218.8W - The outfall is located at Front and Ellis Streets. This is the main village drain. The results of a sample collected from the drain follow:

5-Day BOD	Solids			Anionic Detergents as ABS	M.F.Coliform Count per 100 ml
	Total	Susp.	Diss.		
68	598	57	541	14.5	8,000,000

These results indicate the presence of pollution as a result of sanitary sewer connections to the storm drain.

LE 219.0D - The Wolven St. drain is an open watercourse which was dry at the time of the survey.

LE 219.05D - This open ditch is situated at the east limits of the village and receives drainage from farm land. No flow was evident.

8.2.3 Future Requirements

Soil conditions in the Port Rowan area are not favourable for the use of subsurface disposal systems. Municipal sewage facilities should be provided for the control of water pollution.

8.3 CONCLUSIONS

8.3.1 Water Supply

The extended water treatment plant will provide sufficient capacity to meet the anticipated water requirements. The new facilities will permit more adequate treatment of the raw water and serve to minimize the staining and taste problems previously encountered.

8.3.2 Water Pollution

There is evidence that sanitary sewage from private dwellings in the village is being discharged to storm drains. Individual sewage disposal systems in the built-up area cannot be satisfactorily constructed due to the limited area available. In general, soil conditions in the community of Port Rowan are not favourable for subsurface disposal systems. The Village of Port Rowan should proceed with planning for the eventual construction of pollution control facilities.

Extreme care should be taken in the discharge of wastes from the Innes Foods Co. Ltd. retention pond to provide protection for the municipal water supply.

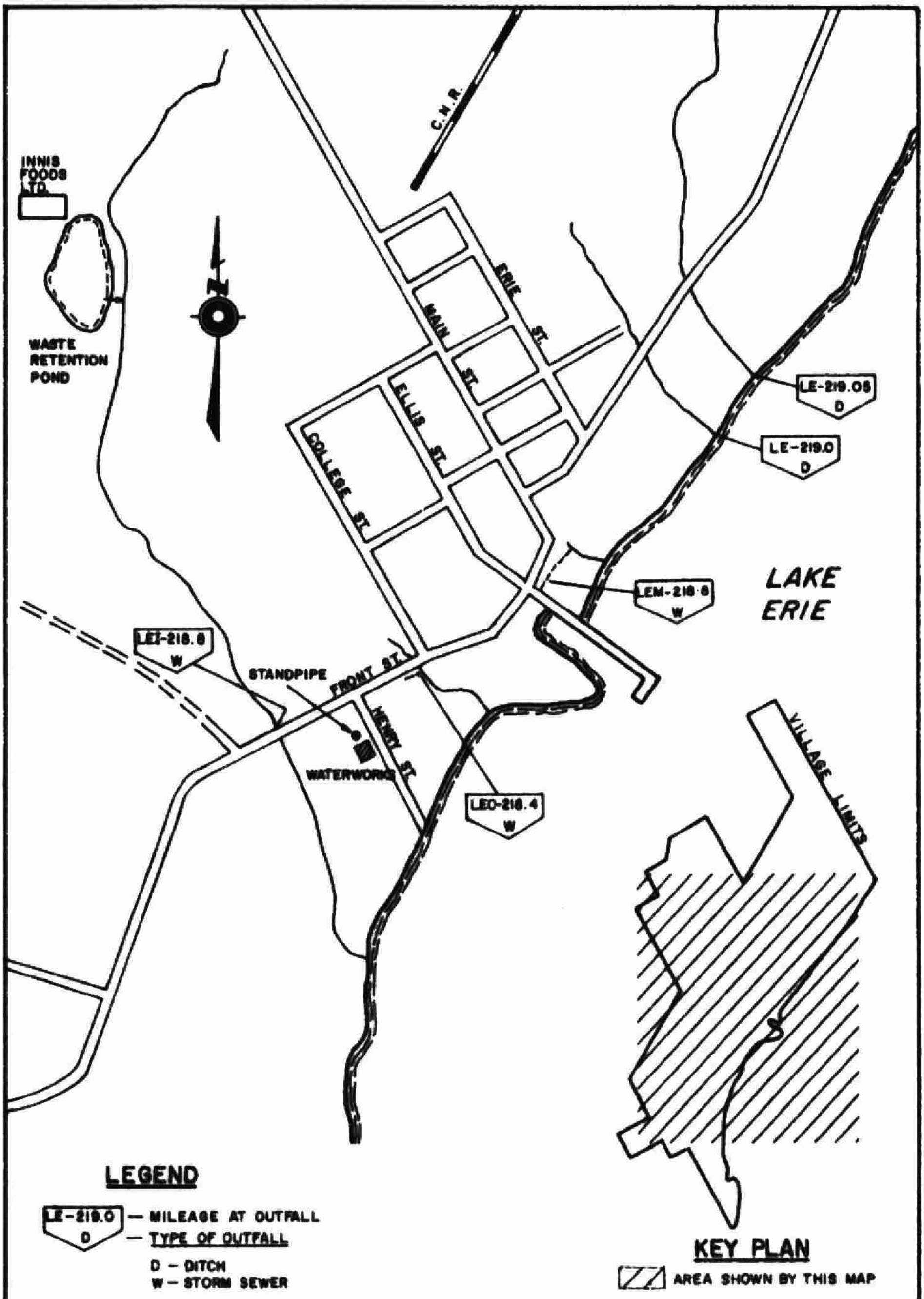


FIGURE 8-1

VILLAGE OF PORT ROWAN

COUNTY OF NORFOLK

SCALE : 1" = 975'

CHAPTER 9

TOWNSHIP OF CHARLOTTEVILLE

CHAPTER 9

TOWNSHIP OF CHARLOTTEVILLE

9.1 WATER SUPPLY

9.1.1 General

Water supplies in the township are obtained by means of private wells and ponds. Drinking supplies are frequently obtained from shallow ground sources. Ponds and wells are commonly used for irrigation. Sand points and dug wells are usual in the northern part of the township, and dug and drilled wells are more prevalent in the southern sections. Drilled wells near Lake Erie obtain water from the bedrock. Although the supplies are usually adequate, the water often contains hydrogen sulphide.

There are a number of private water works systems. A summary of the chemical analyses of these supplies is noted in Table 9-1. Descriptions of the systems follow.

St. Williams Supply

The water works system is operated on a shareholder basis, serving about 30 of the 110 householders in the police village. The population approximates 350 persons.

The source of supply is a deep well located about one-quarter mile west of the community in the Township of Walsingham South. The well was drilled in 1956 and obtains water from the bedrock. It was test pumped at 350 gpm for seven hours. The water contains a high concentration of chloride and some hydrogen sulphide. Treatment consists of aeration for the removal of the hydrogen sulphide.

The well is equipped with a 30 gpm capacity deep well pump. The system consists of 2-inch plastic mains which supply adequate quantities for domestic purposes. Pressures of about 55 psi are maintained by means of a 700 gallon hydropneumatic tank. An ample supply exists and ground-water sources appear adequate to meet future needs.

Herb's Harbour Supply

Herb's Harbour is located on the shore of Lake Erie approximately two miles south-east of the Police Village of St. Williams. There are docking facilities, camp and trailer

TABLE 9-1

WATER QUALITY - PRIVATE WATER SUPPLIES - TOWNSHIP OF CHARLOTTEVILLE

Source	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride as Cl	pH at Lab.	Fluoride as F
Herb's Harbour	210	178	0.13	24	7.6	
Booth's Harbour	130	88	0.40*	28	8.0	
St. Williams Supply	192	146	0.22	349	7.8	1.60
Bowen Supply - Raw	140	102	0.6*	22	7.8	0.20
- treated	126	86	0.12	25	7.9	-
Turkey Point						
- Smythe Supply	181	158	0.1	4	7.8	0.10
- Kish Supply	186	172	0.03	12	8.0	0.10
- Turnbull Supply	192	180	0.05	2	8.0	0.00
- Provan Supply	178	160	0.26	1	7.8	0.10
- Mawhinney Supply	195	182	0.1	4	7.7	0.00
- Turkey Pt. Spring Supply	183	167	0.2	2	8.0	0.05

* Lake Supply - iron concentration depending on turbidity.

sites and some cabins at this location. Domestic water is obtained from a large diameter clay tile buried in the sand on the shore of Lake Erie. It is chlorinated and distributed to the system.

Booth's Harbour Supply

Booth's Harbour is situated on the shore of Lake Erie adjacent to, and west of Herb's Harbour. Water is obtained from two well points sunk in a gravel bed on the lake shore. The water is chlorinated and pumped to approximately 19 cottages and a refreshment booth.

Bowen Supply

The Bowen System is located in the Turkey Point cottage area. Water is drawn from Lake Erie. The treatment consists of settling, pressure filtration and chlorination. The water works system serves approximately 350 cottages, a hotel and a motel.

Turkey Point Supplies

There are a number of small private water systems serving cottages located in the Turkey Point area. The systems are in close proximity to one another and obtain water from a series of springs located in the side of a hill behind the cottage area. A summary of the systems is shown below.

Name	Source	Treatment	No.of Consumers
Smythe Supply	springs	chlorination	25 cottages
Kish Supply	springs	chlorination	unknown
Turnbull Supply	springs	chlorination	25 cottages
Provan Supply	springs	none	32 cottages
Mawhinney Supply	springs	none	20 cottages
Turkey Pt. Spring Supply	springs	none	46 cottages & 18 trailers

9.1.2 Potential Additional Supplies

Ground Water

Additional ground-water supplies are available for domestic and farm purposes. Ground-water surveys would have to be undertaken at the larger centres such as Vittoria, St. Williams, Walsh, Normandale and Lynedoch in order to determine whether ground-water conditions nearby were favourable for municipal wells.

Ground-water supplies represent the most convenient source of domestic water for rural development.

Surface Water

Lake Erie, Young, Fisher and parts of Dedrich and Mud Creeks are available as sources of surface water. Use of these sources for domestic purposes would require treatment. These supplies are of major significance for irrigation purposes and this aspect is discussed in Chapter 3.

9.1.3 Future Requirements

The bacteriological quality of the unchlorinated supplies in the Turkey Point area is unsatisfactory and boiling or chlorination is required. The present arrangement of individual supplies is not adequate to meet future water requirements. An integrated water supply and distribution system should be provided.

Future development of the police villages of Vittoria and St. Williams may necessitate the provision of municipal water supply systems.

9.2 WATER POLLUTION

9.2.1 General

The population distribution in the township is basically rural. There are no municipal or industrial water pollution control plants. Domestic wastes are disposed of by septic tank and pit privy systems. The installation of subsurface disposal systems is supervised by the Norfolk County Health Unit.

9.2.2 Refuse Disposal

The municipal refuse disposal site is located on Concession 1, Lot 14, Township of Charlotteville. A land fill method is used and no pollution problems have been recorded.

9.2.3 Surface Water Quality and Major Sources of Pollution

The Township of Charlotteville is drained in the north-west section by tributaries of Big Creek. The north-east section is drained by Kent Creek, a tributary of the Lynn River.

Young Creek flows through the central and south-eastern sections of the township and empties into Lake Erie. The southern section is drained by small streams which discharge directly into Lake Erie.

Water quality in these streams is generally good. Pollution has been confirmed however in drainage systems serving the built-up communities of St. Williams and Vittoria. This situation is attributed to the discharge of inadequately treated sanitary sewage.

The cottage areas of Turkey Point present a potential source of pollution. Unfortunately, investigations on which this report is based, were carried out after the summer season and representative samples are not available. Visual inspections of the drains indicated the presence of untreated domestic sewage.

9.2.4 Future Requirements

The provision of private disposal systems in the rural areas will likely satisfy the anticipated requirements of the Township of Charlotteville. However, the development of the police villages of Vittoria and St. Williams may necessitate the provision of municipal water pollution control facilities. In the meantime the sources of pollution in the municipal drains should be located and the defective systems corrected.

9.3 CONCLUSIONS

9.3.1 Water Supply

Water supplies utilizing ground-water sources are generally adequate for the current and future needs.

In the Turkey Point area, an integrated water sypply system would be desireable for the entire cottage area.

9.3.2 Water Pollution

The individual disposal systems are generally satisfactory for rural development.

A sanitary survey in the Turkey Point built-up cottage area is required. Any offending private drains should be corrected.

Drainage systems in the police villages of St. Williams and Vittoria should be investigated to trace the sources of pollution. Corrections should be made as required.

CHAPTER 10

TOWNSHIP OF HOUGHTON

CHAPTER 10

TOWNSHIP OF HOUGHTON

10.1 WATER SUPPLY

10.1.1 General

There are no municipal water supply systems within the Township of Houghton. Water supplies are drawn from private wells and ponds. Sand points are common and obtain water from the surface sand that covers most of the township. Dug wells become prevalent near Lake Erie. There are few drilled wells. Ponds and streams are used as sources of water for irrigation.

Water supplies are generally adequate and of satisfactory chemical quality.

10.1.2 Potential Additional Supplies

Ground Water

Additional ground-water supplies can be obtained and developed from shallow aquifers in the overburden in most parts of the township as they are required.

Surface Water

Lake Erie, South Otter, and Clear Creeks are potential sources of surface-water supply. If they are to be used for domestic purposes, treatment will be required. The treatment would consist of chlorination, and possibly coagulation and filtration in cases of high turbidity.

Refer to Chapter 3 for discussion of irrigation use.

10.1.3 Future Requirements

In view of the favourable ground and surface-water conditions prevailing in the township, no difficulty is expected in meeting the anticipated future water requirements.

10.2 WATER POLLUTION

10.2.1 General

Residential development is rural. All disposal of domestic wastes is by means of individual systems.

10.2.2 Refuse Disposal

The municipal refuse disposal site is located approximately two miles west of the hamlet of Fairground. There have been no pollution problems recorded.

10.2.3 Surface Water Quality and Major Sources of Pollution

Parts of the northern and central sections of the township are drained by a tributary of Little Otter Creek. The southern section is drained by Clear Creek.

Sampling surveys of these watercourses within the township have not been considered necessary as there are no known sources of pollution.

10.2.4 Future Requirements

The efforts made to provide adequate private disposal systems should be continued to prevent impairment of the surface-water quality within the township.

10.3 CONCLUSIONS

10.3.1 Water Supply

Water supplies are generally adequate and of satisfactory chemical quality.

10.3.2 Water Pollution

Available information indicates that there are no major sources of pollution in the township.

CHAPTER 11

TOWNSHIP OF MIDDLETON

CHAPTER 11

TOWNSHIP OF MIDDLETON

11.1 WATER SUPPLY

11.1.1 General

Water supplies in the Township of Middleton are obtained from private wells, ponds, and streams. There are no water works systems. The majority of private wells consist of sand points which obtain water from the prevalent surface sand deposit. Drilled wells are found sporadically throughout the township and obtain water from overburden and bedrock aquifers. Overburden wells extend up to depths as great as 185 feet. However, the majority are between 30 and 60 feet deep. Rock wells vary up to 246 feet in depth.

Sand points generally supply adequate quantities of water for domestic and farm purposes. Deeper drilled wells are required where the surface sand is thin or lacking, such as along deeply eroded stream valleys or along the morainic ridge in the western part of the township. Deep rock wells often contain sulphurous water. Ponds, streams, and some ground water are used for the irrigation of tobacco.

11.1.2 Potential Additional Supplies

Ground Water

Additional ground-water supplies are available from overburden aquifers and can be developed as they are required.

The bedrock is a common source of water for deep drilled wells near Courtland. A ground-water survey would be required to determine whether ground-water conditions near the community are favourable for a source of municipal supply.

Surface Water

Little Otter and portions of Big Otter and Big Creeks are potential sources of surface-water supplies. However, treatment would be required before the water could be used for domestic purposes.

Irrigation uses are discussed in Chapter 3.

11.1.3 Future Requirements

There appear to be adequate ground-water resources in this area to meet future domestic requirements.

In the more densely populated areas such as the hamlet of Courtland, the danger of pollution of private water supplies will increase with population growth, and a municipal supply of water may become desirable.

11.2 WATER POLLUTION

11.2.1 General

Courtland is the largest built-up area within the township. Residential subdivision development has occurred immediately west of the Town of Delhi.

Private sewage systems are in use. The installation of these units is under the supervision of the Norfolk County Health Unit.

Courtland Packers and the Canadian Leaf Tobacco Co. are the only industries with significant waste discharges. Courtland Packers employs a septic tank and spray irrigation system for waste treatment. This installation appears adequate to meet pollution control requirements.

The wastes from the Canadian Leaf Tobacco Co. plant are treated by means of a retention pond. The pond contents are discharged to the Big Otter Creek during periods of heavy spring runoff. This arrangement is satisfactory providing that care is taken in selecting a most suitable time for the discharge of the pond contents.

11.2.2 Refuse Disposal

The municipal refuse disposal site is located in a wooded gulley on Lot 20, Concession 1, Township of Middleton. Refuse from the hamlet of Courtland is also disposed of at this site.

11.2.3 Surface Water Quality and Major Sources of Pollution

The Township of Middleton is drained in the central and eastern sections by Big Creek. The western and southern sections are drained by the Little Otter and Venison Creeks respectively.

TABLE 11-1

STREAM AND OUTFALL SAMPLE RESULTS

HAMLET OF COURTLAND - TOWNSHIP OF MIDDLETON

Location	5-Day BOD ppm	Total Solids ppm	Turbidity in Silica Units	Anionic Detergents as ABS (ppm)	M.F.Coliform Count per 100 ml
OL 25.7	1.9	356	5.0	0.0	500
OL 24.8	2.1	360	6.5	0.0	19,000
OL 25.65WD	7.4	1,446	27.0	0.4	207,000
OL 25.6WD	2.7	1,224	6.5	0.0	1,700
OL 25.55WD	2.4	594	2.6	0.7	19,300
OL 25.0WD	6.6	786	5.0	1.0	24,300

OL 25.7 - Little Otter Creek upstream from Courtland.

OL 24.8 - Little Otter Creek downstream from Courtland.

OL 25.65WD- Storm drain outfall, Talbot Road South of Hwy.#59.

OL 25.6WD- Storm drain outfall, Hwy.#59 drain from Courtland Packers Property

OL 25.55WD- Storm drain outfall, south-east of railway tracks, on Hwy.#59

OL 25.0WD- Storm drain outfall, north-west of railway tracks, on Hwy.#59.

The laboratory analyses of stream samples in general indicated satisfactory water quality, with the exception of Little Otter Creek in the Courtland section. Pollution from waste water sources is indicated. Refer to Table 11-1.

11.2.4 Future Requirements

Individual disposal systems will meet the future pollution control requirements in rural areas of the township. In built-up areas, such as Courtland, municipal pollution control facilities may be required if the population increases significantly. The pollution of storm drainage systems should be corrected.

Careful inspection of existing and future septic tank installations in the subdivision area adjacent to Delhi will be required to prevent pollution from faulty or malfunctioning systems. Probably the best long-term pollution control measure would be the provision of municipal sewage collection facilities.

11.3 CONCLUSIONS

11.3.1 Water Supply

The supply is generally adequate where water is obtained from the overburden. Rock wells are used in the western part of the township. Additional ground-water supplies are available from overburden aquifers in most parts of the township and can be developed as required.

11.3.2 Water Pollution

The individual disposal systems utilized throughout the township are generally satisfactory. In the community of Courtland, this is not the case.

In Courtland, where private drains are illegally connected to storm drainage systems, these should be located and disconnected.

Careful inspection of existing and future septic tank installations in the subdivision area adjacent to the Town of Delhi will be required to prevent pollution of surface waters by faulty or malfunctioning systems. Probably the best long-term pollution control measure would be the provision of municipal sewage facilities.

CHAPTER 12

TOWNSHIP OF TOWNSEND

CHAPTER 12

TOWNSHIP OF TOWNSEND

12.1 WATER SUPPLY

12.1.1 General

Water supplies in the Township of Townsend are obtained mainly from private wells. There are no municipal water supply systems.

Dug and drilled wells are common sources of water supply. In many areas, dug wells are the main source of fresh drinking water. Although drilled wells are common, most end in bedrock. It is estimated that probably 50 per cent of these contain hydrogen sulphide.

Water supplies are generally adequate from wells. Occasionally shortages occur in fresh water supplies from dug wells. Ponds are used as a source of water for irrigation in the western parts of the township.

12.1.2 Potential Additional Supplies

Ground Water

Although additional ground-water supplies are available the quality is not desirable. Because of the shallowness of the overburden, additional supplies will need to be obtained from the bedrock. Caution should be exercised in selecting well sites, and in drilling. Fresh water is present in the bedrock in places, but mineral water is usually nearby.

Surface Water

The major stream is Nanticoke Creek. Secondary streams which might be used are Boston and McKenzie creeks, and branches of Black and Patterson creeks. The major use of these sources is for irrigation of farm lands (See Chapter 3). Use for domestic purposes is limited due to low flow conditions and the need for adequate treatment.

12.1.3 Future Requirements

Some difficulty may be expected in obtaining sufficient water of adequate quality to meet the anticipated future demands. The use of water containing hydrogen sulphide will

become more prevalent.

12.2 WATER POLLUTION

12.2.1 General

Sanitary wastes are, in general, treated in septic tank systems or disposed of in private disposal units.

12.2.2 Refuse Disposal

An open disposal area located approximately one mile west of Waterford, and adjacent to a section of the east bank of Waterford pond is used as a refuse dump. The dump is used by the Town of Waterford as well as by the township.

This dump has been identified as a major source of pollution of Nanticoke Creek. The dump operation should be discontinued at the present site. To control the possibility of pollution at a new location, the site should be established at a distance from surface streams in an area with considerable clay and silt overburden. The water table should be below the base of the proposed fill.

12.2.3 Industrial Wastes

VILLA NOVA MILK PRODUCTS CO-OPERATIVE

This company makes milk, butter and cheddar cheese. The factory draws an average of 25,000 gpd of water from three private wells for use in cooling, washup and for steam. The wastes have a high BOD as well as some fat and suspended solids. These wastes are discharged to the land by means of a spray irrigation system.

12.2.4 Surface Water Quality and Major Sources of Pollution

The Township of Townsend lies within the drainage influence of Boston Creek, Nanticoke Creek, and the headwaters of the Black and Patterson Creeks.

These watercourses, with the exception of the Waterford section of Nanticoke Creek, flow through agricultural areas and are free of major pollution.

The laboratory analyses of samples collected from Nanticoke Creek (Table 3-6,Chapter 3) in the vicinity of

Waterford and downstream from the refuse site indicated a high level of pollution.

The analyses of samples collected from a tributary of Nanticoke Creek downstream from the Villa Nova plant have on occasions indicated water quality impairment. This condition can be attributed to runoff from overloaded sections of the spray area, and to underground seepage from the disposal area.

12.2.5 Future Requirements

Individual waste disposal systems appear adequate for present and future pollution control needs of the township. It should be kept in mind however that future urban-type development, should be provided with municipal water pollution control facilities.

12.3 CONCLUSIONS

12.3.1 Water Supply

The existing ground-water supplies are generally adequate; however, a large proportion of the wells extending into bedrock contain hydrogen sulphide. Increased use of bedrock aquifers is foreseen. Available surface water is used primarily for irrigation. Its importance for this purpose will likely continue in the future.

12.3.2 Water Pollution

The township streams, other than Nanticoke Creek, are generally in satisfactory condition. Pollution results from the municipal refuse disposal site, and periodically from the Villa Nova Milk Products Co-operative waste disposal system.

The refuse disposal area should be abandoned and another suitable location selected. Close control over the spray irrigation operations at the Villa Nova Milk Products Co-operative Plant should be maintained at all times to prevent the discharge of untreated wastes to the watercourse.

CHAPTER 13

TOWNSHIP OF WALSINGHAM NORTH

CHAPTER 13

TOWNSHIP OF WALSINGHAM NORTH

13.1 WATER SUPPLY

13.1.1 General

Sand points are the main source of water in areas where surface sand is present. Deep drilled wells are common where the sand is absent, such as along the deeply eroded stream valleys, and in a till area in the central part of the township.

The wells are used mainly for domestic and farm purposes and are generally adequate. Deep wells drilled into bedrock often yield sulphurous water. Ponds are used as a source of water for irrigation.

13.1.2 Potential Additional Supplies

Ground Water

Additional ground-water supplies are available in the Township of Walsingham North. Supplies for domestic and farm purposes may be obtained from the extensive surface sand deposits.

Surface Water

Potentially, Big Creek represents the major source of surface-water supply for domestic purposes. Its use would be limited to larger developments due to the costs involved in making the supply suitable for domestic purposes. Big Creek and its tributaries are of major significance as sources of water for irrigation purposes. Refer to Chapter 3.

13.1.3 Future Requirements

The ground-water supplies appear to be adequate to meet future water demands in the rural areas.

If the population increases in the hamlet of Langton, consideration should be given to the provision of a municipal water supply system.

13.2 WATER POLLUTION

13.2.1 General

Individual septic tank systems and pit privies are used for domestic waste disposal. The installation of subsurface disposal systems is controlled by the Norfolk County Health Unit.

13.2.2 Refuse Disposal

There is no municipal refuse disposal programme. The collection and disposal of refuse is carried out under private contract.

13.2.3 Surface Water Quality and Major Sources of Pollution

The major portion of the Township of Walsingham North is drained by Big Creek.

Water quality of the stream throughout the township has been generally satisfactory. However, intermittent pollution, possibly from agricultural sources, is indicated (Table 3-3).

13.2.4 Future Requirements

The continued provision of private disposal systems will likely satisfy future requirements. Municipal water pollution control facilities are not required unless large scale residential development occurs, or major industries locate within the township.

13.3 CONCLUSIONS

13.3.1 Water Supply

Ground-water sources appear to be adequate to meet the normal, anticipated increases in population. Surface water is widely used for irrigation and livestock watering.

13.3.2 Water Pollution

Major sources of pollution are unknown.

CHAPTER 14

TOWNSHIP OF WALSINGHAM SOUTH

CHAPTER 14

TOWNSHIP OF WALSINGHAM SOUTH

14.1 WATER SUPPLY

14.1.1 General

Water supplies are obtained from private wells and ponds. Sand points are the main source of water on Long Point and in the northern half of the township, where a surface sand deposit is found. Dug wells are the common source of water in the clayey southern area of the township. The wells are generally adequate for domestic and farm purposes. Well records indicate that there is a lack of deep overburden aquifers. Water is obtained from the bedrock at depths of 250 to 300 feet but is often sulphurous. Ponds are used as a source of water for irrigation.

14.1.2 Potential Additional Supplies

Ground Water

Additional ground-water supplies for domestic and farm purposes are available from shallow overburden aquifers. Some difficulty will likely be encountered in locating deep overburden aquifers. Water is present in the bedrock but is usually mineral in quality.

Walsingham is the largest community in the township. In the event that a water-supply system is considered for the community a ground-water survey should be carried out to determine whether ground water might be utilized.

Surface Water

Lake Erie, Big Creek and Dedrich Creek, are the major surface-water sources in the township. Their use for domestic purposes would, however, require treatment consisting of chlorination, and possibly coagulation and filtration during periods of high turbidity. Refer to Chapter 3 for irrigation uses.

14.1.3 Future Requirements

Ground-water sources are generally adequate to meet future water demands for domestic and farm purposes.

14.2 WATER POLLUTION

14.2.1 General

The residential development of the Township of Walsingham South is basically rural. The economy is based on agricultural production. The disposal of domestic wastes is carried out by means of individual systems.

14.2.2 Refuse Disposal

The municipal refuse disposal site is located on Lot 16, Concession 2, Township of Walsingham South. A trench and fill system is utilized.

14.2.3 Surface Water Quality and Major Sources of Pollution

The Township of Walsingham South is drained by Big Creek and Dedrich Creek. Intermittent pollution, possibly from agricultural sources, is indicated (Table 3-3).

In 1959 a fish kill was reported near the mouth of Big Creek. Although not proven, it appeared that the mortalities may have been related to the flushing of a tank truck containing pesticides.

14.2.4 Future Requirements

The efforts made to provide adequate private disposal systems should be continued in the future to prevent deterioration of the surface-water quality within the township.

14.3 CONCLUSIONS

14.3.1 Water Supply

Water supplies are generally adequate for the rural areas. In the event that a municipal supply is considered in the larger communities, such as the hamlet of Walsingham, a ground-water survey should be carried out to determine whether a suitable ground-water source could be obtained.

14.3.2 Water Pollution

Available information indicates that there are no major sources of pollution in the township.

CHAPTER 15

TOWNSHIP OF WINDHAM

CHAPTER 15

TOWNSHIP OF WINDHAM

15.1 WATER SUPPLY

15.1.1 General

Domestic and rural water supplies are obtained from private wells, ponds, and streams. The surface sand which covers most of the township serves as the main source of water for wells. A good supply of water is often obtained by means of sand points or shallow drilled wells in the overburden. Deeper drilled wells are frequently required to obtain water in areas along the morainic ridges. These wells provide sufficient quantities of water from the bedrock but the water is usually high in mineral content.

In general, there is no problem in obtaining sufficient water for domestic purposes. Ponds, streams, and some ground water are used for the irrigation of tobacco.

15.1.2 Potential Additional Supplies

Ground Water

Additional ground-water supplies can be obtained and developed in most areas from aquifers in the overburden as they are required. Well records indicate that aquifers occur at depths up to 140 feet in the overburden. In a few areas where overburden aquifers are not adequate to supply water for all purposes, bedrock aquifers could likely be used to supplement this supply for some uses such as stock-watering.

When water works systems are considered for larger communities such as Windham Centre and Teeterville, ground water might be a suitable source of supply, but a ground-water survey and test-drilling programme would be required to determine this. Ground-water supplies are sufficient to satisfy most potential rural development that may occur.

Surface Water

The surface-water supplies, at present are of major importance for irrigation. Refer to Chapter 3.

15.1.3 Future Requirements

It is likely that the future domestic and stock water supply requirements can be satisfied from private wells.

Future development of the Teeterville and Windham Centre areas may necessitate the provision of municipal water supply systems.

15.2 WATER POLLUTION

15.2.1 General

The installation of private sewage disposal systems usually employed in the township is supervised by the Norfolk County Health Unit.

15.2.2 Refuse Disposal

The main refuse disposal site is located on the north-west section of Lot 4, Concession 14, Township of Windham. An additional refuse disposal site is located on Lot 23, Concession 8. The latter site is used primarily for refuse disposal from the hamlet of La Salette. A third site is located on Lot 14, Concession 5. This site has been used for the disposal of refuse from the hamlet of Teeterville. The area has been posted by the municipality, as being no longer available for use.

15.2.3 Surface Water Quality and Major Sources of Pollution

The Township of Windham is drained by Big Creek, Patterson Creek and Nanticoke Creek. The north, central, and western sections are drained by Big Creek; the north-east section by Nanticoke Creek; and the south-east section by Patterson Creek.

The sanitary chemical and bacteriological analyses of water samples collected from the watercourses throughout the township indicated satisfactory water quality. There are no known major sources of pollution in the township.

15.2.4 Future Requirements

Future development of the built-up areas in the township may necessitate the provision of municipal water pollution control facilities.

15.3 CONCLUSIONS

15.3.1 Water Supply

In general, water supply for domestic purposes from ground-water sources is adequate.

15.3.2 Water Pollution

Available information indicates that there are no major sources of pollution in the township.

CHAPTER 16

TOWNSHIP OF WOODHOUSE

CHAPTER 16

TOWNSHIP OF WOODHOUSE

16.1 WATER SUPPLY

16.1.1 General

The water supplies in the Township of Woodhouse are obtained mainly from private wells. There are a number of privately owned supply systems. A development area adjacent to the Town of Port Dover is serviced by the Port Dover municipal water supply system.

In the western parts of the township, sand points are the main source of water. Generally adequate supplies are obtained for domestic and farm purposes.

In the eastern parts of the township, dug and drilled wells are the common source of water supply. Drilled wells in these areas obtain water from the bedrock which contains varying amounts of hydrogen sulphide. There are a number of reports of fresh drinking water shortages from dug wells in these areas. Along Lake Erie, where wells are generally unsuccessful, water supplies are often obtained from the lake. In some cases water is treated by chlorination or boiling.

16.1.2 Public Supplies

Water quality is summarized in Table 16-1.

Bint Supply

The R. Bint supply is located immediately south of the Town of Simcoe. The system, consisting of 5 well points driven to a depth of 25 feet, pumping equipment, and a 20,000 gallon reservoir, supplies water to approximately 60 consumers. The water is of good quality and no treatment has been required to date.

Norfolk County Park

Norfolk County Park is a 30-acre tract of land located on the shore of Lake Erie near Port Ryerse. Water is obtained from a well 150 feet deep. The water is chlorinated and supplied to 28 trailer sites and the park area. The park receives approximately 4,000 visitors per day on weekends during the summer months.

Vaughan Subdivision Supply

The Vaughan Subdivision is located on the shore of Lake Erie approximately 3 miles east of Port Dover. The water for this system is obtained from Lake Erie by means of an intake pipe extending approximately 500 feet into the lake. This water is provided with chlorine treatment prior to its distribution to 30 cottages.

Adelina Park Subdivision Supply

The Adelina Park Subdivision is located on the shore of Lake Erie approximately one-half mile east of the Vaughan Subdivision. Water from Lake Erie is supplied to a number of cottages. Since any surface water may be subject to contamination, this water should not be used for human consumption without prior boiling or chlorination.

Crescent Bay Supply

The Crescent Bay supply serves 18 cottages located on the shore of Lake Erie, approximately 4 miles east of the Town of Port Dover. Raw water from Lake Erie is pumped to an elevated storage tank. The water in the tank is chlorinated manually each day before distribution to the system.

16.1.3 Potential Additional Supplies

Ground Water

Additional ground-water supplies are available in the township, except in the eastern sections where shortages occur in dug wells. Highly mineralized water is usually obtained from drilled wells. Locating dug wells in low areas might make them more adequate.

Surface Water

Lake Erie represents the most suitable source of surface water. The water from the Lynn River and Black Creek is limited in its application for domestic purposes by the degree of treatment required.

TABLE 16-1

WATER QUALITY

PRIVATE WATER SUPPLIES - TOWNSHIP OF WOODHOUSE

Location	Hardness as $CaCO_3$	Alkalinity as $CaCO_3$	Iron as Fe	Chloride as Cl	pH at Lab.	Fluoride as F
Bint Supply	686	238	0.02	24	7.4	0.05
Norfolk County Park Supply	334	164	0.12	185	7.6	1.1
Adelina Park Subdivision Supply	136	100	0.15*	24	7.6	-
Vaughan Subdivision Supply	170	152	0.66*	19	7.8	-
Crescent Bay Supply	132	98	0.42*	26	8.0	-

* Lake Supply - iron concentration depending on turbidity

16.1.4 Future Requirements

In view of the limited ground-water supplies, particularly in the eastern section of the township, increased reliance will have to be placed on surface-water resources.

16.2 WATER POLLUTION

16.2.1 General

Considerable recreational development exists along the shore of Lake Erie. All pollution control measures are on an individual basis under the supervision of the Norfolk County Health Unit.

16.2.2 Refuse Disposal

The refuse disposal site for the Township of Woodhouse is located on the south-east portion of Lot 4, Concession 1.

A portion of the disposal area extends into a swamp which lies within a small unnamed watershed draining directly into Lake Erie. The refuse disposal site constitutes a potential source of pollution especially during periods of high water.

16.2.3 Surface-Water Quality and Major Sources of Pollution

The Township of Woodhouse is drained almost entirely by the Lynn River and the Black Creek.

The Lynn River provides drainage for the western section of the township, including the towns of Simcoe and Port Dover.

The laboratory analyses of samples collected from the stream indicate progressive deterioration in water quality as the stream flows through the Town of Simcoe (Table 4-2) and the Town of Port Dover (Table 6-1).

The pollution is caused by the discharge of inadequately treated domestic and industrial wastes to the watercourse from the aforementioned municipalities (Tabel 4-3 and Table 6-2).

The Black Creek drains the northern, central, and eastern areas of the township. The water quality is

satisfactory in the rural sections (Table 6-1). However, deterioration is evident as the stream flows through the north-east part of Port Dover (Table 6-2).

16.2.4 Future Requirements

In order to improve the water quality of the Lynn River measures are necessary to prevent the discharge of polluting materials to the stream.

The towns of Simcoe and Port Dover are instituting sewerage programmes which will be major factors in controlling pollution.

Care must be taken to ensure that inadequately treated wastes are not discharged to the streams from any built-up areas in the township. Septic tank systems are used generally to treat sanitary wastes in these areas. It is therefore necessary that continued supervision be given to the installation and operation of these disposal systems.

16.3 CONCLUSIONS

16.3.1 Water Supply

The water needs of the western section of the township are being met from ground-water sources. The eastern part of the township has a limited supply of satisfactory ground water.

Lake Erie is a significant source of supply for cottage developments along its shore. Three of five existing privately-owned supplies obtain water from the lake. Ground water serves the remaining two systems.

Since surface water may be subject to contamination, it should not be used for domestic consumption without prior disinfection by boiling or chlorination.

Water Pollution

The water quality of the Lynn River is seriously impaired below the municipalities of Simcoe and Port Dover. Pollution control measures being undertaken by these municipalities will substantially reduce the degree of pollution in this stream and Lake Erie.

APPENDIX

EXPLANATION & SIGNIFICANCE OF LABORATORY ANALYSES

All the laboratory tests included in this report were performed at the Ontario Water Resources Commission Laboratory in Toronto.

A. BACTERIOLOGICAL EXAMINATION

Bacteriological examinations were performed on samples from water supplies, streams, and outfalls. The Membrane Filter Technique was used to obtain a direct enumeration of coliform organisms. These organisms are normal inhabitants of the intestines of man and other warm blooded animals. They are always present in large numbers in sewage and are generally minimal in other stream pollutants.

The results of the examinations are reported as "M.F. Coliform Count per 100 ml".

The Commission's objective for stream sanitation is a coliform density of not greater than 2,400 organisms per 100 ml.

B. STREAM AND OUTFALL SAMPLES

The chemical analyses performed on stream and outfall samples include determinations for biochemical oxygen demand, suspended solids, turbidity, and in some instances, pH, and alkyl benzene sulfonate (ABS).

BIOCHEMICAL OXYGEN DEMAND (BOD):

Biochemical Oxygen Demand is reported in ppm and is an indication of the amount of oxygen required for the stabilization of decomposable organic matter present in sewage, polluted waters, or industrial wastes. The completion of the laboratory test requires five days, under the controlled incubation temperature of 20°C.

The Commission objective for stream water quality is an upper limit of 4 ppm.

SOLIDS:

The laboratory carries out tests to determine the total and suspended solids in a sample. The value for dissolved

solids is determined by taking the mathematical difference between the total and suspended solids.

The concentration of suspended solids expressed in parts per million (ppm) is generally the most significant of the solids analyses in regard to stream water quality. The effects of suspended solids in water are reflected in difficulties associated with water purification, deposition in streams, and injury to the habitat of fish.

Where suspended solids values approach 20 ppm or less, laboratory difficulties are experienced and, excepting the samples from sewage treatment works, the values of suspended matter are usually determined as turbidity.

TURBIDITY:

Turbidity is caused by the presence of suspended matter, such as clay, silt, finely divided organic matter, plankton and other microscopic organisms in water. It is an expression of the optical property of a sample and results are reported in "Silica Units".

pH:

The pH is an index of the acidity or alkalinity of the solution as represented by the instantaneous hydrogen ion concentration. The practical pH scale extends from 0, very acid, to 14, very alkaline, with the middle value of pH 7 corresponding to exact neutrality (at 25°C.). The objectives for surface-water quality as adopted by the OWRC suggest that the pH of the waters following initial dilution, should not be less than 6.7 nor greater than 8.5.

ABS (ALKYL BENZENE SULFONATE):

The alkyl benzene sulfonate portion of the anionic detergents are reported in ppm. The test is generally employed to indicate the presence of illegal discharge of waste water to storm drains.

The popular use of synthetic detergents for general cleaning purposes has resulted in the incidence of residual ABS in streams. As an objective, the ABS concentration should not exceed 0.5 ppm in water used for domestic purposes.

C. WATER SUPPLIES

The chemical analyses performed on water used as a source of supply for municipal or private systems include; hardness, alkalinity, chlorides, iron, fluoride, pH, turbidity, and colour.

HARDNESS:

No specific limit is usually placed on hardness although it is usually recommended that waters for domestic use should contain less than 250 ppm hardness as $CaCO_3$. This recommended limit has been used to avoid excessive soap consumption and other problems, primarily economic, usually associated with hard water. The degrees of hardness are indicated as:

Soft	-	0-60 ppm as $CaCO_3$
Moderately Hard	-	61-120 ppm as $CaCO_3$
Hard	-	121-180 ppm as $CaCO_3$
Very Hard	-	greater than 180 ppm as $CaCO_3$

ALKALINITY:

Alkalinity of natural waters is due to the presence of salts of weak acids, usually bicarbonates. The concentration is reported in ppm as $CaCO_3$ and is significant in determining aggressive tendencies and softening treatment requirements.

CHLORIDES:

Chlorides are naturally present, in varying concentrations, in water supplies. Increasing chloride concentration may indicate contamination from domestic sewage.

The recommended maximum concentration to avoid saline tastes is 250 ppm.

IRON:

The recommended maximum limit for iron in water supplies is 0.3 ppm. It is noted that waters with concentrations of iron in excess of 0.3 ppm are not harmful to consumers but have objectionable staining and sediment-forming properties, and may cause the deposition of iron in pipes or the growth of iron bacteria. If the concentration exceeds 1 ppm, problems with metallic taste may occur.

FLUORIDE:

Fluoride may occur naturally in water or it may be artificially applied at the supply and/or treatment works.

A fluoride concentration of approximately 1 ppm is considered beneficial in the prevention of dental caries. The recommended maximum and minimum limits of fluoride are 1.2 ppm and 0.8 ppm respectively.

TURBIDITY:

The significance of turbidity is included in Section B.

The turbidity of treated water should not exceed 5 Silica Units.

COLOUR:

The colour intensity of water is reported in Hazen Units.

The colouration of natural water may result from contact with organic matter or chemical substances.

The recommended maximum colour content is 15 Hazen Units.

ABBREVIATIONS

ABS	alkyl benzene sulfonate
avg.	average
BOD	biochemical oxygen demand
COD	chemical oxygen demand
cont'd	continued
Commission	Ontario Water Resources Commission
cfs	cubic feet per second
diss.	dissolved
gpd	gallons per day
gpm	gallons per minute
gpcpd	gallons per capita per day
max.	maximum
M.F.	membrane filter
ml	millilitres
mgd	million gallons per day
mi.	miles
min.	minimum
no.	number
OWRC	Ontario Water Resources Commission
pH	hydrogen ion concentration
ppb	parts per billion
ppm	parts per million
PUC	Public Utilities Commission
S.S.	Suspended Solids
susp.	suspended
tot.	total
Twp.	Township
WPCP	Water Pollution Control Plant
%	per cent
>	greater than
<	less than
#	number

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